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ORD PUBLICATIONS SUMMARY

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Office of Research and Development
Washington, D.C. 20460

FOREWORD

This is the first issue of the Office of Research and Development's (ORD's) quarterly **ORD PUBLICATIONS SUMMARY**. This **Summary** is intended to provide a current listing (since July 1973) of ORD's final reports on in-house, grant, contract, and interagency projects. A New Report Abstracts Section is included in the **Summary** to provide brief abstracts of recently printed reports, as well as indices by Title, Program Area (subject), Performing Organization, Personal Author, Report Number, and Grant, Contract, or Interagency Agreement Number to aid the reader in identifying reports of interest. Instructions on how to order copies of reports are on the inside of the front cover. Comments on how this **Summary** would serve the reader more effectively would be appreciated.

WK Talley
Wilson K. Talley
Assistant Administrator for
Research and Development

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SERIES DESCRIPTION

The U.S. Environmental Protection Agency (EPA) was formed in late 1970 from programs in several executive agencies, i.e., the Department of Health, Education, and Welfare (air pollution, solid waste, radiation, water hygiene, and noise), the Department of the Interior (water pollution), and the Department of Agriculture (pesticide regulation).

In July 1972, EPA's Office of Research and Monitoring (now Office of Research and Development, ORD) established an office-wide series of designations within which each research report would be published. The series can be used to describe the general thrust of EPA research and development and also to aid in identifying the use for each report. The present numbering system and cover color for each report is keyed to this Series Description. In addition, ORD's research program has been categorized into 10 major Program Areas that serve to identify subject matter: these are described beginning on page vii.

SERIES 1 – ENVIRONMENTAL HEALTH EFFECTS RESEARCH (yellow covers)

Assigned to Series 1 are projects and studies relating to the tolerances of man for unhealthful substances or conditions, generally assessed from a medical viewpoint. In addition to toxicology and other medical specialties, study areas include physiological or psychological studies, and biomedical instrumentation and health research techniques utilizing animals—but always with intended application to human health protection.

SERIES 2 – ENVIRONMENTAL PROTECTION TECHNOLOGY (light blue covers)

Within Series 2 is research performed to develop and demonstrate instrumentation, equipment, and methodology to repair or prevent environmental degradation from point and nonpoint sources of pollution. This work provides the new or improved technology necessary to control and treat pollution sources so that environmental quality standards can be met.

SERIES 3 – ECOLOGICAL RESEARCH (light green covers)

In Series 3 are grouped the investigations on pollution effects on plant and animal species and on materials. Problems are assessed for their long- and short-term influences and studies include formation, transport, and pathway studies to determine the fate of pollutants and their effects. This work provides the basis for setting standards to minimize undesirable changes in living organisms in the aquatic, terrestrial, and atmospheric environments.

SERIES 4 – ENVIRONMENTAL MONITORING (gray covers)

Research conducted to develop new or improved methods and instrumentation for identifying and quantifying environmental pollutants is found in Series 4. Also included are studies to determine the ambient concentrations of pollutants in the environment, or the variance of pollutants as a function of time or meteorological factors, or both.

SERIES 5 – SOCIOECONOMIC ENVIRONMENTAL STUDIES (rust covers)

Included in Series 5 is research devoted to the socioeconomic impact of environmental problems, i.e., recycling and other recovery operations whose emphasis is on monetary incentives and nonscientific realms of legal systems, cultural values, and business systems. Because the interdisciplinary scope of system evaluations and environmental management, these reports are included in Series 5.

SERIES 6 – SCIENTIFIC AND TECHNICAL ASSESSMENT REPORTS (STAR) (dark blue covers)

In Series 6 are assessments of the available scientific and technical knowledge on major pollutants that would be helpful in regulatory decision making or assessments of a major area of completed study. The series is used to present objective evaluations of existing knowledge— evaluations that point out the extent to which it is definitive, the validity of the data on which it is based, and the uncertainties and gaps that may exist. (Most of the reports are multimedia in scope and focus on single media only to the extent warranted.)

SERIES 9 – MISCELLANEOUS (covers of various designs)

Series 9 is used for all reports issued by ORD not applicable to one of the series described above.

USERS' GUIDE

This volume contains an abstract section, a bibliographic section, and six indices. Within each index, reports are cross-referenced to the Bibliographic Section by report number.

NEW REPORT ABSTRACTS SECTION

This section contains a brief abstract of each recently printed report. If no source is shown in the Bibliographic Section, the report is not yet available. Future issues of the **Summary** will note those reports for which an abstract has been published and indicate the issue in which the abstract appeared; e.g., ---Abstracted 600/9-74-001a---.

BIBLIOGRAPHIC SECTION

In the Bibliographic Section is a numerical listing of reports published since July 1973. The source of each report follows the bibliographic entry, and how to order instructions are given on the inside front cover.

The major ORD organizations (Headquarters; Washington Environmental Research Center (WERC); and National Environmental Research Centers (NERC) responsible for preparing the report can be identified:

600 = ORD Headquarters, RD-674 (Washington, DC 20460; 202/426-2175)
and WERC (Washington, DC 20460; 703/557-7484)
650 = NERC-RTP (Research Triangle Park, NC 27711; 919/549-8411)
660 = NERC-Corvallis (Corvallis, OR 97330; 503/752-4211, X. 440)
670 = NERC-Cincinnati (Cincinnati, OH 45268; 513/684-8258)
680 = NERC-Las Vegas (PO Box 15027, Las Vegas, NV 89114; 702/736-2969)

TITLE INDEX

All reports are listed alphabetically by title; "A," "An," and "The" have been dropped from the beginnings of titles.

PROGRAM AREA INDEX

This Program Area Index provides a broad subject-matter index; each report is listed once, alphabetically by title, under the Program Area concerned with the report's research. These Program Areas contain sub-areas called Program Elements; these are the numbers appearing in the second column of the Bibliographic Section (e.g., 1BB037). Reports not falling within these Program Areas, such as bibliographies or annual reports, are listed under Miscellaneous Reports.

The objectives and responsibilities within each of the 10 Program Areas are:

HEALTH EFFECTS—assessing health hazards associated with environmental pollution from a number of media and categories including air, water, pesticides, radiation, and noise. Major program emphasis is devoted to evaluating, through community epidemiologic studies, the effects of exposure to common pollutants on sensitive health indicators and to assessing at the community level, the effects of pollutants on human physiology.

ECOLOGICAL PROCESSES AND EFFECTS-determining the effects of air and water pollutants on the structure and function of ecosystems and on biotic and abiotic subcomponents of these ecosystems. Programs on aquatic systems determine the acute and chronic effects of pollutants (e.g., temperature, pesticides, heavy metals) on life stages of fresh and marine water fish, invertebrates, and their food-chain organisms. Specific air pollutant studies include the effects of nitrogen oxides, sulfur oxides, hydrocarbons, and oxidants on representative terrestrial ecosystems. Also included are studies seeking alternative methods of pest control that have great specificity on target organisms and little or no effects on nontarget organisms.

USERS'GUIDE

MUNICIPAL POLLUTION CONTROL-developing and demonstrating technology applicable to controlling and treating wastewaters generated in and discharged from the urban environment. The entire urban drainage system is included, from sewer systems carrying stormwater and sewage (combined sewers) and from urban stormwater discharges.

INDUSTRIAL POLLUTION CONTROL-demonstrating the best practicable, best available, and zero pollution control technology (with emphasis on water reuse and product-by-product recovery) for manufacturing industries defined by the Standard Industrial Classification, Major Groups 19-39.

NONPOINT POLLUTION CONTROL-developing means to (1) predict and assess the impact of pollutants from nonpoint sources on waters from various land-use patterns; (2) determine the reduced pollutant load that results from implementing specific nonpoint source controls and the costs of achieving these reductions to meet established water quality standards; (3) establish limits of reasonable controllability for nonpoint sources; and (4) establish specific control guidelines for nonpoint sources.

Specific objectives include developing cost-effective, nonpoint management systems (with alternatives appropriate for various geographical and geological areas) for activities in: agriculture including forestry and logging operations; agricultural runoff; irrigation return flows; confined animal feeding; aquaculture and disposal of nonagricultural sludges; active mining operations and abandoned mining sites; hydrological modifications; and oil and hazardous material spills.

AIR POLLUTION CONTROL-ensuring the availability of control devices, processes, and approaches for control of air pollutants at their source. Currently, activity is in research and development of control technology in four principal areas: (1) sulfur oxides— historically, emissions from electric power generating plants; recently, from industrial combustion and process sources; (2) nitrogen oxides—in the area of combustion control and nitrogen oxide effluent treatment processes; (3) particulates—the need for fine particulate control technology and more economic conventional technologies; and (4) hazardous and other pollutants—those not included in the above three categories.

DATA AND INFORMATION RESEARCH-planning, coordinating, establishing, reviewing, and assessing research; and developing and demonstrating programs aimed at effective research information and data systems, including multimedia or multipollutant data analysis and special data handling and processing studies.

EQUIPMENT AND TECHNIQUES-developing methods and instrumentation for the detection, identification, and quantification of pollutants in all media at the lowest significant concentration. Included are state-of-the-art reviews, prototype instrumentation development, and pioneering research studies related to developing new or significantly improved analytical methods or instrumentation.

QUALITY ASSURANCE-planning, establishing, and coordinating an Agency-wide standardization and quality control program to ensure that environmental data produced by Federal, State, and local agencies are compatible, accurate, and legally defensible; and ensuring the selecting, standardizing, and publishing of procedures and methods for sampling and analyzing environmental pollutants.

SOCIOECONOMIC RESEARCH-developing and demonstrating analytical and management techniques required to implement Agency programs at the national, regional, and local levels. Interdisciplinary research is focused on the analysis of three general areas: (1) ecological impact—effects of various environmental policies and development of comprehensive environmental planning and management capability; (2) resources—economic aspects of environmental actions including cost-benefit, cost-risk benefit, and trade-off analysis; and (3) implementation and methods—developing forecasting capability to anticipate long-range impact of human and institutional activities on the environment.

PERFORMING ORGANIZATION INDEX

This is an alphabetical listing of the organizations that actually conduct ORD research projects. For grants or contracts, the organization is the grantee or contractor; for in-house reports, the organization is the EPA laboratory or office.

PERSONAL AUTHOR INDEX

The Personal Author Index lists alphabetically all authors of reports contained in the Bibliographic Section.

GRANT, CONTRACT, INTERAGENCY AGREEMENT NUMBER INDEX

This index contains a listing of ORD Contract, Grant, and Interagency Agreement numbers for which a final report has been produced. For each number listed the applicable report number is cross-referenced.

NEW REPORT ABSTRACTS SECTION

600/1–75–001 PE 1GB090 ROAP/TASK 21 AXV IN-HOUSE PROJECT

Federal Noise Effects Research: FY 73 – FY 75 Noise Technology Staff, EPA Washington, DC

Potential effects of noise on the public health and welfare are described, limitations and gaps in necessary knowledge of those effects are identified as research needs, and eight categories for analyzing noise effects research are presented. The current Federal research programs are summarized for each of the eight categories. The Noise Effects Research Research Panel through its collective knowledge of the needs and the current research has identified specific research areas which need additional emphasis in order to provide accurate and thorough information on effects of noise. The Panel concluded that the current programs need continued and in some instances expanded support in order to provide necessary information on the effects of noise. Some areas of concern which are not currently being addressed are also identified. EPA CONTACT: Berkau, G.

600/2–74–009a PE 1BB036 ROAP/TASK 21 AZR 006 GRANT NO. 800857

Effluents of the Inorganic Pesticide Industry BY J. Patterson, Illinois Institute of Technology Chicago, IL

A literature and field study of the manufacture of inorganic pesticides revealed that many inorganic formulations are still widely used for agricultural purposes. The inorganic pesticide industry is a small but distinct segment of the total agricultural chemical industry. Its manufacturing processes and wastewaters contrast sharply with those associated with organic pesticides. The inorganic pesticide market is dominated by eight products, each of which is discussed in this report with respect to its manufacturing effluent characteristics and applicable pollution control technology. Based upon field studies, it has been demonstrated that five of the eight products can be manufactured without generating any process wastewater. Aqueous effluents from the manufacture of the remaining three inorganic pesticides appear to be directly controllable by previously demonstrated in-plant control and/or wastewater treatment technologies. EPA CONTACT: Des Rosiers, P. 202–755–0448

600/2–74–009b PE 1BB036 ROAP/TASK 21 AZQ 029 GRANT NO. 800857

Pollution Control in the Commercial Explosives Industry BY J. Patterson, Illinois Institute of Technology Chicago, IL

A literature and field study of the commercial explosives industry reveals that on the basis of products manufactured, plant size, and the nature of the wastewater, the industry may be divided into three segments. One, complex facilities, are large plants manufacturing a variety of explosives and intermediate products. The second category is small specialized formulation plants, typically limited to blending explosives formulations for use in nearby mining activities. The final category is specialty product facilities, devoted to manufacture of select ingredients such as lead azide and other explosives initiators, blasting caps, electric matches and similar appurtenance items. The explosives industry discharges large volumes of wastewater, typically high in BOD, nitrogen, and solids, frequently at extreme pH, and containing trace to high quantities of dissolved and particulate explosives products. Although pollution abatement technology has not been widely implemented within the explosives industry, there is a potential for significant abatement of pollutant discharge by good housekeeping practice, application of proven treatment technology and under certain conditions total wastewater containment. EPA CONTACT: Des Rosiers, P. 202–755–0448

600/2–74–009c PE 1BB036 ROAP/TASK 21 AZQ 029 GRANT NO. 800857

Effluents of the Inorganic Gas Industry BY J. Patterson, Illinois Institute of Technology Chicago, IL

A literature and field study of the inorganic gas industry revealed that the industry is dominated by (1) air separation plants producing argon, nitrogen and/or oxygen, (2) hydrogen plants and (3) carbon dioxide plants. The major effluent of the industry is cooling water, which may be contaminated with raw product condensates, oil and grease, and water supply and cooling water treatment chemicals. Spent scrubber solutions from product purification may also consititute a significant waste, although newer production technology eliminates this aspect, as well as oil and grease. EPA CONTACT: Des Rosiers, P. 202–755–0448

600/2–75–001 PE 1BB036 ROAP/TASK PEMP 03 IN-HOUSE PROJECT

Projects in the Industrial Pollution Control Division – December 1974 Industrial Pollution Control Division, EPA Washington, DC

Projects of the Industrial Pollution Control Program – December 1974 is a compilation of information sheets from projects initiated since fiscal year 1967 through fiscal year 1974. Each sheet contains the objectives, statistical information, and a brief description of the project. General introductory information on the Federal Industrial Pollution Control Program is also presented to provide perspective on the magnitude of industrial pollution and the research directions that must be pursued in order to develop the technology to adequately control this largest point source of pollution in the United States.

600/2–75–002 PE 1GB090 ROAP/TASK 21 AXV IN-HOUSE PROJECT

Federal Surface Vehicle Noise Research, Development, and Demonstration Program: FY 73 – FY 75 Noise Technology Staff, EPA Washington, DC

The Interagency Surface Vehicle Noise Research Panel was established by the Environmental Protection Agency to aid EPA in fulfilling its responsibility for coordinating the Federal noise research activities. As its initial task, the Panel prepared this report summarizing the Federal governments' surface vehicle noise research, development, and demonstration activities. The Federal agencies which sponsor and/or conduct the major portion of the surface vehicle noise RD&D are represented on the Panel. They are the Department of Transportation, the Departmet of Commerce/ National Bureau of Standards, the Department of Defense, and the EPA. Other agencies which sponsor surface vehicle noise research are the Department of Agriculture and the National Science Foundaion. The report contains brief descriptions and fiscal data for the agencies' programs. Emphasis is on fiscal years 1973 through 1975. Also included are references and bibliographies of reports and publications which have resulted from the Federal surface vehicle RD&D activities. EPA CONTACT: Berkau, G. 202–755–0449

NEW REPORT ABSTRACTS SECTION

600/5–75–002 PE 1HA095 ROAP/TASK 21 ART 11 IAG NO. IAG-148(D)

Secondary Impact of Transportation and Wastewater Investments: Review and Bibliography BY S. B. Bascom, K. G. Cooper, M. P. Howell, A. C. Makrides, and F. T. Rabe, Environmental Impact Center Newton, MA

The Bibliography contains a review of over fifty major studies and three hundred relevant reports related to secondary environmental impacts on various forms of public investments, e.g. land based transportation and wastewater collection systems. The Bibliography is organized into four sections: Section I is subdivided into: (a) a review of secondary impacts classified according to type of investment (highways, mass transit, and wastewater collection systems); (b) where possible, according to type of secondary effects (economic, social and land use); (c) a brief summary of modeling techniques which may be utilized to analyze and project likely secondary environmental impacts. Section II condenses the findings of about fifty major studies related to land transportation and wastewater treatment systems. Section III is an annotated bibliography of about three hundred relevant studies. Section V classifies these literature studies by: (a) impact; (b) investment; (c) geographic area examined; (d) type of study; and (e) type of analytic techniques used in assessing secondary effects. EPA CONTACT: Scherer, R.

600/5–75–003 PE 1HA098 ROAP/TASK 21 AKL 02 GRANT NO. 801419

Land Use Forms and the Environment – An Executive Summary BY B. J. Berry, Chicago, University of Chicago, IL

This executive summary contains highlights of the full study which focused on the relationship between land use forms and environmental quality. It investigated the influence of the spatial distribution of land rises on the pollutants generated and the resulting environmental quality. The investigation was assisted by the preparation of a "sorted table" in which the "rows" are the various urban forms and land use patterns and the "columns" are the several classes, types and elements of environmental pollution. A comparative analysis of the materials assembled for the table determined trends across the urban forms and land use types, focusing particularly on the identification of those land use forms that naturally generate the least pollution. Also, parallel investigation of national trends in population distribution and land use was performed, so that some expectations could be developed as to the likely impacts on pollution of current patterns of regional growth and change. EPA CONTACT: Patterson, P.

600/5–75–004 PE 1BA030 ROAP/TASK 16 AFN 03 CONTRACT NO. 68–01–1863

Analysis of Nonpoint-Source Pollutants in the Missouri Basin Region BY A. D. McElroy, F. Y. Chin, and A. Aleti, Midwest Research Institute Kansas City, MO

A study was conducted of nonurban, nonpoint sources of pollution in the Missouri Basin utilizing a unique, computer-based data system. The Data Bank contains extensive information on land use, soil, climate, water quality, and other parameters in the Missouri Basin. The current study was concerned with the adequacy of the Data Bank relative to development of nonpoint pollution models. Evaluation of information in the Data Bank yielded detailed land use and water quality profiles in the basin. The results show that the Data Bank is a useful base to depict the basinwide relations between various land uses and water quality. Regression equations of these relationships were developed for individual subbasins as well as for the entire basin. The regression equations, and the accompanying statistical analysis of significance, indicated that the water quality parameters NO3, BOD, and turbidity correlate well with land use on a basinwide basis. Other parameters, namely phosphorus, dissolved oxygen, and dissolved solids, did not correlate well with land use. EPA CONTACT: Rose, M.

600/9-74–002 PE 1RW103 IN-HOUSE PROJECT

Indexed Bibliography of Office of Research and Development Reports – Updated to January 1975 OR&D, Publication Staff, EPA Washington, DC

This bibliography is a current listing of the Office of Research & Development's final reports on in-house, grant, contract, and interagency projects. Reports are indexed by Title, Program Area (subject), Performing Organization, Personal Author, Report Number, and Grant, Contract, or Interagency Agreement Number to aid the reader in identifying reports of interest. Instructions on how to order copies of reports are on the inside of the front cover.

660/2–74–070 PE 1BB044 ROAP/TASK 21 ASS 001 IN-HOUSE PROJECT

Extended Aeration Sewage Treatment in Cold Climate BY H. J. Coutts, and C. B. Christianson, Arctic Environmental Research Laboratory, EPA College, AK

To develop design criteria for biological treatment of low temperature domestic sewages, two parallel low temperature extended aeration units near Fairbanks, Alaska, were designed and operated. The two units had exposed aeration basins utilizing submerged aerators and were differentiated by type of clarifier. One unit had conventional horizontal flow clarifier while the other had a modified upflow clarifier with tube settlers. The liquid temperature varied from 0°C to 19°C. In addition, 0.5 MGD subarctic, oxidation ditch and low temperature bench scale units were studied. Organic loading was the parameter most seriously affected by low temperatures. EPA CONTACT: Latimer

660/2–74–094 PE 1BB036 ROAP/TASK 21 AZR 006 GRANT NO. 801577

Pollution Control Technology for Pesticide Formulators and Packagers BY T. L. Ferguson, Midwest Research Institute Kansas City, MO

The pesticide formulation and packaging industry transforms bulk pesticidal chemicals into packaged, ready-to-use form for sale to the consumer. Most pesticides are formulated in plants completely separate from the site of active ingredient manufacture. About 32,000 formulated products are federally registered to approximately 3,400 companies for interstate sale. Most are apparently formulated in 200 to 300 large formulation plants through the country. Techniques used to dispose of process wastewater include evaporation, landfill disposal, contract disposal services, including municipal systems. Current pretreatment and treatment techniques for process wastewater discharge are generally considered inadequate to meet increasingly stringent standards. The best practicable wastewater treatment technology appears to be complete evaporation. The best available treatment technology appears to be a pretreatment-filtration-adsorption process under development. Additional research is needed to: characterize the wastewater; assess the air pollution potential due to pesticides; and demonstrate the pretreatment-filtration-adsorption process. EPA CONTACT: Warner, A. 404–546–3160

NEW REPORT ABSTRACTS SECTION

660/2–75–001 PE 1BB037 ROAP/TASK 21 BAB 30 GRANT NO. 801432

Waste Citrus Activated Sludge As a Poultry Feed Ingredient BY R. H. Jones, J. T. White, and B. L. Damron, Winter Garden Citrus Products Cooperative Winter Garden, FL

This report presents an evaluation of the potential of utilizing waste activated sludge as a poultry feed supplement. The sludge used in this study was obtained from an activated sludge process treating concentrated citrus waste containing no sanitary wastewater. The sludge was thickened, dewatered and dried using full-scale and pilot-scale equipment. The dried sludge was then analyzed for protein, fiber, amino acids, nutrients and moisture. Poultry feeds containing varying concentrations of sludge were prepared. Two experiments with broiler chicks, each of three weeks duration, one 8-week broiler study, and a six-month laying hen study were conducted to determine the effect of the inclusion of sludge in poultry diets on performance. It is shown in this report that the inclusion of sludge in properly formulated diets up to 7.5 percent did not significantly affect poultry performance or meat or egg quality. The value of the sludge was calculated based on the reduction in feed ingredients resulting from the inclusion of sludge. It was found that the value of the recovered sludge significantly reduced the total cost of sludge handling. EPA CONTACT: Thompson, H.

660/2–75–002 PE 1BB037 ROAP/TASK 21 BAB 10 GRANT NO. 12060 HPC

Pilot Scale Treatment of Wine Stillage BY E. D. Schroeder, California, University of Davis, CA

Pilot and laboratory scale studies were run on aerobic and anaerobic biological treatment of winery stillage over a two year period. The pilot scale studies included work with aerobic lagoons and anaerobic packed towers. Laboratory systems studied were aerobic reactors without recycle and batch fed anaerobic processes. Because suspended solids removal proved to be a key factor in successful biological treatment, centrifugation, detartration, coagulation and flocculation, and combinations of these methods were included in the studies. Centrifugation proved to be the best method of removing solids prior to biological treatment. Solids removal in combination with an aerobic treatment process can be expected to produce final filtrate chemical oxygen demands of about 700 mg/1 and a final filtrate BOD of about 75 mg/1. Anaerobic processes studied did not operate well but produced effluents with chemical oxygen demands of the order of 4000 mg/1. EPA CONTACT: Cochrane, M.

660/2–75–003 PE 1BB039 ROAP/TASK 21 BES 14 GRANT NO. 801454

Livestock and the Environment—A Bibliography with Abstracts, Volume II BY R. H. Ramsey, M. L. Rowe, and L. Merryman, East Central Oklahoma State University Ada, OK

Management and research information on animal wastes has expanded rapidly in recent years. This material has appeared in such diverse sources as journal articles, conference proceedings papers, university publications, government publications, magazine articles, books, and theses. This bibliography was compiled in order to speed the flow of information on findings in one segment of the livestock industry to other segments that could benefit from this technology. Included in this publication are the following indexes: (1) title, (2) author, (3) keyword, (4) animal information categories. These indexes are followed by a section of abstracts of each reference entry found in the bibliography. Single copies of most articles can be obtained in hard copy or microfiche form at cost from the Animal Waste Technical Information Center, School of Environmental Science, East Central Oklahoma State University, Ada, Oklahoma 74820. (Ramsey-East Central) EPA CONTACT: Wood, M. L.

660/2–75–004 PE 1BB037 ROAP/TASK 21 AZX 27 GRANT NO. 12040 EJU

Activated Carbon Treatment of Unbleached Kraft Effluent for Reuse BY E. W. Lang, W. G. Timpe, and R. L. Miller, St. Regis Paper Company Pensacola, FL

A four-year pilot plant program was carried out to investigate the technical and economic feasibility of treating unbleached kraft pulp and paper mill effluent for reuse. Preliminary laboratory studies and cost estimates indicated that the following treatment sequences should be investigated in the pilot plant: 1) primary clarification, carbon adsorption; 2) lime treatment, carbon adsorption; 3) primary clarification, bio-oxidation, carbon adsorption. Water of reusable quality can be provided from unbleached kraft effluent by several combinations of treatment utilizing activated carbon. Unbleached pulping effluents typically contain about 1000 color units, 250 mg/1 BOD. Reusable water quality as defined in this study is 100 color units and 100 mg/1 TOC. The most economical treatment is the microlime-carbon process that utilizes low dosages of lime and clarification followed by carbon adsorption in down-flow granular carbon beds. Capital cost for treatment by this process of 9.6 mgd of unbleached kraft effluent from an 800-ton-perday mill was estimated to be approximately $6.7 million. Operating costs, inclusive of capital depreciation, were estimated to be $0.30 per 1000 gal and $3.58 per pulp ton, including credit for the reused water. Carbon adsorption in continuous counter-current stirred contactors was found to have promise of lower operating cost and substantially lower capital costs as compared to adsorption in fixed beds. EPA CONTACT: Ruppersberger, J.

660/2–75–005 PE 1BB039 ROAP/TASK 21 AYS 05 GRANT NO. 801040

Management Practices Affecting Quality and Quantity of Irrigation Return Flow BY L. G. King, and R. J. Hanks, Utah State University Logan, UT

Field and laboratory research was conducted to determine the effects of irrigation management and fertilizer use upon the quality and quantity of irrigation return flow. The total seasonal discharge of salts from the tile drainage system was directly related to the quantity of water discharged, because the solute concentration of the ground water was essentially constant over time. Under such conditions, reduction of salt content of return flow is accomplished by reduced drain discharge. Irrigation management for salinity control must be practiced on a major part of a particular hydrologic unit so that benefits are not negated by practices in adjoining areas. Field studies and computer models showed that salts may be stored in the zone above the water table over periods of several years without adversely affecting crop yields on soils with high "buffering" capacity as encountered in this study. However, over the long term, salt balance must be obtained. Appreciable amounts of nitrate moved into drainage water at depths of at least 106 cm from the applications of commercial fertilizer and dairy manure to ground surface. Submergence of tile drains in the field reduced nitrate concentrations in the effluent, especially under heavy manure applications. This report was submitted in fulfillment of Grant No. S801040 by Utah State University under the partial sponsorship of the Environmental Protection Agency. Work was completed as of November 30, 1973. EPA CONTACT: Law, J. P.

NEW REPORT ABSTRACTS SECTION

660/2–75–007 PE 1BB045 ROAP/TASK 21 ASH 02 GRANT NO. 801400

Water Quality Effect of Diking a Shallow Arid-Region Lake BY D. K. Fuhriman, L. B. Merritt, J. S. Bradshaw, and J. R. Barton, Brigham Young University Provo, UT

The inflow, outflow, and in-lake water quality and quantity of Utah Lake in Central Utah was studied over a 36-month period. The work was undertaken to determine the effect of a proposed diking project on the quality and quantity of lake water and to develop methodology for determining the effect of diking or other management practices on the quality of water in any lake system. A computer simulation model was developed which is able to analyze the effect of a given management program on the water quality of the lake, particularly as related to the "conservative salts" present. The simulation model was also used to evaluate the evaporation from the lake by use of a salt balance technique. Results of the research indicate that the diking of Utah Lake will have a positive beneficial effect upon the water quality of the lake and will also result in considerable saving of water and reclamation of valuable land. EPA CONTACT: Leach, L.

660/2–75–008 PE 1BB045 ROAP/TASK 21 ASJ 02 GRANT NO. 800731

Role of Trace Elements in Management of Nuisance Growths BY T. Bott, R. Patrick, and R. Larson, Academy of Natural Sciences of Philadelphia Philadelphia, PA

The purpose of these studies was to examine the effects of various kinds and amounts of trace metals on the structure of algal communities and their possible subsequent effect upon the productivity of the aquatic ecosystem. To carry out this program of study, the following trace metals were examined: vanadium, chromium, selenium, boron, nickel, and rubidium. The results of these experiments indicate the concentration and form of a trace metal may have a definite effect upon which algal species can out-compete others. These shifts may greatly reduce the productivity of the system as a whole. If the shift is to species which has such lower predator pressure, large standing crops which may be nuisances may develop. EPA CONTACT: Duffer, W. R.

660/3–74–013 PE 1EA077 ROAP/TASK 10 AKC 018 IN-HOUSE PROJECT

Theoretical Model and Solubility Characteristics of Aroclor R 1254 in Water: Problems Associated with Low-Solubility Compounds in Aquatic Toxicity Test BY W. P. Schoor, Gulf Breeze Environmental Research Laboratory, EPA Gulf Breeze, FL

A theoretical model of the behavior of substances having low water-solubility is presented and discussed with respect to aqueous bioassay. Ultracentrifugal techniques were used in an attempt to study size distributions of Aroclor 1254 aggregates in aqueous emulsions. Results indicate strong adsorption from emulsion by surfaces and a water-solubility at 20°C of less than 0.1 micrograms/liter in distilled water and approximately 40% of that value in water containing 30 grams/liter NaCl. Implications with regard to aqueous bioassay are discussed. EPA CONTACT: Valmus, A. (Librarian)

660/3–74–017 PE 1BA031 GRANT NO. 16010 ELF

Silt Removal From a Lake Bottom Lake Herman Development Associates, Inc. Madison, SD

Dredging was used as a method to remove 62,600 cubic yards of silt from Lake Herman during the summers of 1970, 1971, and 1972. The silt was transported via a pipeline to a silt deposit area adjacent to the northeast corner of the lake. The water removed by the dredging process drained by gravity along a gradual slope, dropping its silt and losing nutrients to the lush vegetation, and eventually returned to the lake. In the bay area where dredging occurred water depth was increased from 5.5 feet to approximately 11 feet. There was no significant change in the levels of biological organisms or nutrients, except for phosphorus, which increased just after the dredging began. Whether dredging actually caused the increase is still debatable. Vegetation in the deposit area became extremely lush. Water returning to the lake from the deposit area was lower in nutrients than the water in the lake. This report was submitted in fulfillment of Contract Number 16010 ELF under partial sponsorship of the Water Quality Office, Environmental Protection Agency.

660/3–74–028 PE 1BA026 ROAP/TASK 21 AKP 011 GRANT NO. 800778

Cladophora Distribution in Lake Ontario (IFYGL) BY C. T. Wezernak, D. R. Lezenga, and F. C. Polcyn, Environmental Research Institute of Michigan Ypsilanti, MI

Multispectral remote sensing data were collected along the U.S. shoreline of Lake Ontario, under the sponsorship of the Environmental Protection Agency, as part of the International Field Year on the Great Lakes (IFYGL) program in Lake Ontario. Data were processed to show the distribution of *Cladophora* in the nearshore zone and to estimate the standing crop. Additionally, thermal data in the study area were displayed. The results show an extensive growth and development of *Cladophora* in the study area. Approximately 66% of the nearshore zone in the western portion of the lake and 79% in the eastern portion, is covered by *Cladophora*. Several major and minor thermal features and thermal discharges were evident at several locations along the U.S. shoreline. EPA CONTACT: Mullen, M. 313–226–7911

660/3–74–029 PE 1BA026 ROAP/TASK 25 ADX 003 GRANT NO. 801062

Future Dredging Quantities in the Great Lakes BY C. N. Raphael, E. Jaworski, C. Ojala, and D. S. Turner, Eastern Michigan University Ypsilanti, MI

Based on historical records, an overview and projection of U.S. and Canadian dredging quantities in the Great Lakes are presented. Using current pollution criteria, future quantities of polluted maintenance dredging are estimated for each lake. Recent environmental policies have influenced dredging and particularly disposal practices. These policies, as well as sedimentation, lake levels, and economic factors are discussed in relation to dredging. During the next decade, maintenance and private dredging volumes will not change significantly, whereas new work will decrease. As in the past, most maintenance dredging will occur in U.S. projects, particularly in Lake Erie. EPA CONTACT: Mullen, M. 313–226–7911

NEW REPORT ABSTRACTS SECTION

660/3–74–033 PE 1BA024 GRANT NO. 800994

Salt Water Detection in the Cimarron Terrace, Oklahoma Oklahoma Water Resources Board Oklahoma City, OK

The objectives of this project were to demonstrate the applicability of surface resistivity techniques to delineate salt water contamination in a shallow alluvial aquifer, to outline areas of salt water contamination in a valuable terrace aquifer, to permit safe future development, and to identify the sources of such contamination. Surface resistivity using the Wenner spread and both Barnes layer and apparent resistivity interpretive methods was found useful in outlining areas of major water quality changes where the geologic environment was simple and the terrace composed of sand. However, where clay was present in the terrace or where the bedrock relief was large, surface resistivity was not found to be an accurate definitive tool. Two large areas of salt water contamination were intensively studied by test drilling. In one of these areas resistivity was extensively used. Brine contamination of one of these areas was attributed to oil field brine evaporation pits while the other area was contaminated by natural brines from the underlying bedrock. The sodium/chloride ration was used to identify the source of brines. EPA CONTACT: Scalf, M. R.

660/3–75–001 PE 1EA077 ROAP/TASK 25 AJN 10 IN-HOUSE PROJECT

Impact of the Use of Microorganisms on the Aquatic Environment BY D. G. Ahearn, Georgia State University Atlanta, GA BY A. W. Bourquin, Gulf Breeze Environmental Research Laboratory, EPA Gulf Breeze, FL BY S. P. Meyers, Louisiana State University Baton Rouge, LA

Proceedings of a symposium-workshop to determine the possible impact of artificially introducing microbial insect control agents or oil-degrading agents into the aquatic environment. The efficacy and safety testing, especially against non-target aquatic organisms, for use of bacteria, viruses, fungi, and protozoa to control aquatic insect pests is discussed with remarks of panel members representing government, academia, and industry. Special attention is given to persistence of pathogens in aquatic environments as well as control of aquatic weeds and other non-insect pests. Summary papers are presented for each panel concerned with microbial pesticides and one summary for the session on microbial degradation of oil. Excellent bibliographies are presented with each paper and discussion. EPA CONTACT: Bourquin, A. W. 904–377–5268

660/3–75–002 PE 1BA032 ROAP/TASK 21 AJH 12 GRANT NO. 800613

Effect of Meteorological Variables on Temperature Changes in Flowing Streams BY R. W. Troxler, and E. L. Thackston, Vanderbilt University Nashville, TN

A mathematical model for predicting the change in water temperature in a flowing stream as a function of stream geometry and standard weather information was developed and tested. Five field tests were conducted on cold water released from hydro-power stations as it warmed up moving downstream over periods up to 38 hours. Predictions of temperature changes were made based on (a) weather data from a boat floating with the water, (b) data from a station on the bank, and (c) data from a remote weather station 100 miles away. Agreement between predicted and observed temperature changes was good, even with remote data, when adjustments to compensate for the local micro-climate were made. Computer programs and all data are included. EPA CONTACT: Tichenor, B. 503–752–4348

660/3–75–003 PE 1BA031 ROAP/TASK 21 AIZ 15 GRANT NO. 801003

Eutrophication of Surface Waters—Lake Tahoe's Indian Creek Reservoir Lake Tahoe Area Council South Lake Tahoe, CA

From April 1969 to October 1974 field and laboratory analyses and observations were made at approximately weekly intervals to evaluate the relationship between the quality of water impounded at Indian Creek Reservoir (ICR) and the reclaimed water exported by the South Tahoe Public Utility District. The reclaimed water comprised from 70 to 80 percent of the annual impoundment. It is concluded that the reservoir responds to more complex factors than are measurable by analysis of reclaimed water. The results show why a system of wastewater reclamation must be designed on the basis of the natural as well as the man-controlled components of the system, and points the way to the necessary parameters and institutional concepts if water is to be reclaimed for a specific purpose. EPA CONTACT: Maloney, T.

660/3–75–004 PE 1BA026 ROAP/TASK 21 AKP 07 GRANT NO. 800605

Phytoplankton Composition and Abundance in Lake Ontario During IFYGL BY E. F. Stoermer, M. M. Bowman, J. C. Kingston, and A. L. Schaedel, Michigan, University of Ann Arbor, MI

Based on samples collected during the International Field Year for the Great Lakes, the phytoplankton assemblage of Lake Ontario is dominated by taxa indicative of degraded water quality, including many potentially nuisance producing species. Many taxa characteristic of the offshore waters of the upper Great Lakes are either absent from flora or very rare. Compared to the upper lakes, the flora of Lake Ontario undergoes extreme seasonal succession, with diatoms predominating during the winter and early spring, green algae becoming abundant during the summer, and blue-green algae showing a distinct fall peak. Various species of microflagellates are a relatively important element of the flora during all seasons. EPA CONTACT: Davies, T. T.

660/3–75–005 PE 1BA026 ROAP/TASK 21 AKP 15 GRANT NO. 800610

Mathematical Modeling of Phytoplankton in Lake Ontario BY R. V. Thomann, R. P. Winfield, and D. M. DiToro Manhattan College Bronx, NY

The basic mathematical structure for describing the dynamics of phytoplankton in Lake Ontario is presented in this report. Data on chlorophyll and principle nutrients are reviewed and summarized and the mathemmatical modeling strategy is detailed. The modeling strategy begins with the construction of a horizontally completely mixed lake with vertical layers, LAKE 1. This spatially simplified model is used to develop the interactions and kinetic behavior of the various components of each subsystem. A more detailed 3-dimensional model is then used to describe open lake and near shore variations in phytoplankton biomass. Ten biological and chemical variables are used in both models and include four trophic levels above the phytoplankton, chlorophyll as a measure of phytoplankton biomass two phosphorus components and three nitrogen components. Under reasonable sets of model parameters as reported in the literature, the Lake 1 model output compared favorably with observed data on the dependent variables. Spring growth and peak chlorophyll concentrations are related primarily to increasing light and temperature. The model indicates that growth ceases due to phosphorus limitation. The results to date indicate that the mathematical model of phytoplankton in Lake Ontario as developed herein is a reasonable first approximation to observed data. As such, the model can form a basis for preliminary estimates of the effects of nutrient reduction programs on Lake Ontario. EPA CONTACT: Richardson, B.

NEW REPORT ABSTRACTS SECTION

660/3–75–006 **PE 1BA026** **GRANT NO. 800609**

Phosphorus Uptake and Release by Lake Ontario Sediments BY R. T. Bannerman, D. E. Armstrong, R. F. Harris, and G. C. Holdren, Wisconsin, University of Madison, WI

Sediment cores were obtained from 15 lake stations representing the three major basins and the Inshore Zone of Lake Ontario. Cores were sectioned for characterization of the surface sediments according to inorganic P chemical mobility. Physical mobility was characterized by measurement of P release from intact cores incubated under controlled laboratory conditions. The proportions of potentially chemically mobile inorganic P were usually high (30 to 60%) in the central basin sediments and low (2 to 8%) for the inshore zone sediments. Although the amounts of inorganic P desorbed after three successive equilibrations (in .1M NaC1) of Lake Ontario sediments represented only 3 to 17% of the potentially mobile inorganic P, sufficient inorganic P was desorbed to restore a large part of the original interstitial inorganic P concentrations. EPA CONTACT: Thomas, N.

660/3–75–008 **PE 1BA031** **ROAP/TASK 21 AJF** **IN-HOUSE PROJECT**

Marine Algal Assay Procedure Bottle Test National Environmental Research Center, EPA Corvallis, OR

Describes protocol for a standardized primary producer nutrient bioassay for assessment of the effect of cultural eutrophication in estuarine and coastal marine areas. It is a companion procedure to the freshwater ALGAL ASSAY PROCEDURE: BOTTLE TEST, EPA, August, 1971. The green biflagellate unicellular alga *Dunaliella tertiolecta* Butcher (DUN clone) was selected as the bioassay organism because of its wide salinity tolerance, sensitivity to incremental additons and natural levels of critical or limiting nutrients, excellent replication and simple evaluation characteristics. Contains numerous references. EPA CONTACT: Maloney, T. E.

660/3–75–009 **PE 1BA021** **IN-HOUSE PROJECT**

Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians National Water Quality Laboratory, EPA Duluth, MN

Four detailed methods for conducting acute toxicity tests with freshwater, estuarine, and marine fish, macroinvertebrates, and amphibians are presented in an integrated format. Nomenclature is consistent with that used in other branches of toxicology. Concepts incorporated into the methods are applicable to toxicity tests with most aquatic organisms. This report was prepared by the Committee on Methods for Toxicity Tests with Aquatic Organisms under the partial sponsorship of the U.S. Environmental Protection Agency. Work was completed as of December, 1974. EPA CONTACT: Stephan, C. E.

660/3–75–010 **PE 1BA021** **ROAP/TASK 16 AA1 10 IAG NO. IAG-152(D)**

Studies to Determine Methods for Culturing Three Freshwater Zooplankton Species BY D. B. Martin, and J. F. Novotny, U.S. Fish and Wildlife Service Yankton, SD

Studies to determine laboratory methods for culturing unispecific populations of *Bosmina longirostris, Chydorus sphaericus* and *Cyclops bicuspidatus thomasi* were carried out. These cultures are to provide a source of animals to be used as live food for fish and as bioassay test organisms. *B. longirostris* was not successfully cultured. High mortalities, apparently associated with the phenomenon of "air-locking", always occurred during handling in the laboratory. *C. sphaericus* was successfully maintained in relatively dense cultures (approximately 1,000 per liter) using a mixture of dried foods, less that 37 microns in size. One-fourth of the standing crop was harvested each week without apparently reducing the production in the culture. *C. bicuspidatus thomasi* could be grown using both dried food and live *Paramecium multimicronucleatum* as an energy source. However, the latter resulted in higher standing crops. Total standing crop as well as the proportion of each life stage in the population fluctuated greatly in the *C. bicuspidatus thomasi* cultures. Both *C. bicuspidatus thomasi* and *C. sphaericus* were grown at 15°C, at a light:dark cycle of 12:12 hours, and in a synthetic medium of known chemical composition. *C. sphaericus* was recommended as being best suited for live fish food and as a bioassy test animal. EPA CONTACT: Siefert, R. E.

660/3–75–011 **PE 1BA021** **ROAP/TASK 16 AAK 17 IAG NO. IAG-141(D)**

Acquisition and Culture of Research Fish BY J. L. Brauhn, and R. A. Schoettger, U.S. Department of Interior Columbia, MO

Rainbow trout *(Salmo gairdneri)*, channel catfish *(Ictalurus punctatus)*, fathead minnows *(Pimephales promelas)*, and bluegills *(Lepomis macrochirus)* are cultured widely for toxicological research. However, vacillant or extreme cultural conditions are sometimes suspected of compromising the test animals and, thus, results of comparative or confirmatory research. Because exact optimum conditions for indoor maintenance and culture of the four species are not well defined, we have adopted standardized practices that are intended to reduce cultural conditions to a common variable status. Water quality, nutrition, genetic variation, diseases, fish handling, gross behavior, and required facilities are discussed. Well known propogation techniques provide the basis for the intensive care methods used. Special emphasis is given to diets, diet preparation, and residues of pesticides or other contaminants in diets and fish. EPA CONTACT: Mueller, L.

660/3–75–012 **PE 1BA023** **ROAP/TASK 03 ACQ 09** **IN-HOUSE PROJECT**

Modeling Dynamics of Biological and Chemical Components of Aquatic Ecosystems BY R. R. Lassiter, Southeast Environmental Research Laboratory, EPA Athens, GA

To provide capability to model aquatic ecosystems or their subsystems as needed for particular research goals, a modeling strategy was developed. Submodels of several processes common to aquatic ecosystems were developed or adapted from previously existing ones. Included are submodels for photosynthesis as a function of light and depth, biological growth rates as a function of temperature, dynamic chemical equilibrium, feeding and growth, and various types of losses to biological populations. These submodels may be used as modules in the construction of models of subsystems or ecosystems. A preliminary model for the nitrogen cycle subsystem was developed using the modeling strategy and applicable submodels.

NEW REPORT ABSTRACTS SECTION

660/3–75–013 PE 1BA025 ROAP/TASK 21 AIS 08 GRANT NO. 800365

Analysis of the Dynamics of DDT in Marine Sediments BY J. H. Phillips, E. E. Haderlie, and W. L. Lee, Stanford University Pacific Grove, CA

The concentrations of DDT, DDD and DDE were measured in sediments at 57 stations in Monterey Bay on the Central California coast during 1970–1971. Mean concentrations in parts per billion were DDT 3.1, DDD 2.3, and DDE 5.4. During 1973 nineteen of the original stations were sampled. Mean concentrations were DDT 15.5, DDD 2.3, and DDE 5.4 PPB. Laboratory assays were developed to determine the relative rate of decomposition in sediment under conditions selective for various physiologically different kinds of microorganisms. Decay under aerobic conditions was greater than under anaerobic conditions. Nitrate increased the rate of decomposition under anaerobic conditions. The Q10 for decay was 2.5. EPA CONTACT: Baumgartner, D. J.

660/3–75–014 PE 1BA032 ROAP/TASK 21 AJH 15 GRANT NO. 800435

Flow Establishment and Initial Entrainment of Heated Water Surface Jets BY H. Stefan, L. Bergstedt, and E. Mrosla, Minnesota, University of Minneapolis, MN

Mathematical modeling of the zone of flow (re-)establishment (ZFE) of heated water surface jets has been found to be difficult because of the complex dependence on outlet geometry, discharge velocity, buoyancy, and ambient currents. Laboratory experiments have therefore been conducted to provide more observations and data on flow patterns, temperatures, and flow velocities in the ZFE and some distance beyond. EPA CONTACT: Shirazi, M.

660/3–75–015 PE 1EA077 ROAP/TASK 10 AKC 40 GRANT NO. 802348

Effects of Mirex and Methoxychlor on Striped Mullet, Mugil cephalus L. BY C. E. Nash, and J. R. Sylvester, Oceanic Foundation Waimanalo, HI

The effects of two chlorinated insecticides, mirex and methoxychlor, on striped mullet, *Mugil cephalus* L., were studied. Test concentrations of both insecticides used were 0.01, 0.1, 1.0 and 10.0 ppm in dynamic bioassay. Young juveniles were more susceptible to mirex exposure than older juveniles or adults. No mortalities occurred in older juveniles and adults exposed to mirex for 96 hours. For young juveniles, mortalities were highest in concentrations of 0.1 and 1.0 ppm and were less in concentrations of 0.01 and 10.0 ppm. Significant amounts of mirex residues were accumulated in the body tissues of the test fish; concentrations increased with increased environmental concentrations. Methoxychlor was more toxic to mullet than mirex. Mortalities were greater than 90 percent over a 96-hour period for all life stages studied at concentrations of 0.1, 1.0 and 10.0 ppm. Mortality at a concentration of 0.01 was 5.1 percent or less for 96 hours. Relative to mirex, small amounts of methoxychlor residues accumulated in the tissues of the test fish. Results of the experiments on eggs and larvae were inconclusive. Egg survival was slightly better in mirex than in methoxychlor over a 96-hour period. Larval survival was generally better in mirex than methoxychlor. EPA CONTACT: Hansen, D. J.

660/4–75–001 PE 1BA027 ROAP/TASK 16 ADN 38 IN-HOUSE PROJECT

Determination of Molecular Hydrogen Sulfide BY T. B. Hoover, Southeast Environmental Research Laboratory, EPA Athens, GA

The gas sparging technique and a new gas-sensing electrode were evaluated for the determination of dissolved molecular hydrogen sulfide at environmentally significant concentrations in water. From the sparging experiments approximate coefficients were obtained for the distribution of hydrogen sulfide between nitrogen and distilled water, seawater, or municipal sewage effluent. In the latter medium the volatility of hydrogen sulfide was very much less than predicted from the pH-total sulfide relationship. The electrode, consisting of various semipermeable membranes, buffered electrolyte filling solution, silver-silver sulfide crystal sensor, and lanthanum fluoride internal reference electrode, gave a generally Nernstian response to more than 0.1 mg/1 of molecular hydrogen sulfide. At lower concentrations the response was typically several tenths of a volt per decade of concentration, but was not reproducible among different samples or electrodes. Various sources of the anamalous behavior were considered. The electrode is recommended for *in situ* measurements of molecular hydrogen sulfide at concentrations greater than 0.1 mg/1. More work is needed to make it useful at lower concentrations.

660/4–75–002 PE 1BA027 ROAP/TASK 16 ADN 64 GRANT NO. 802980–01

Aqueous Odor Thresholds of Organic Pollutants in Industrial Effluents BY D. A. Lillard, and J. J. Powers, Georgia, University of Athens, GA

This investigation was designed to determine the odor thresholds in water of organic pollutants that have been identified in industrial effluents. Seven to fourteen judges were used to determine the odor threshold values of 13 compounds at room temperature and 60°C. Extreme value calculations were made to predict a concentration below which a certain percentage of the population might still be able to detect the compound(s). The threshold values obtained at 60°C in most cases do not differ or are higher than those determined at room temperature. EPA CONTACT: Webb, R. G.

660/9-74–002 PE 1BB045 IN-HOUSE PROJECT

Great Lakes Water Quality — Status of Pertinent EPA Research BY A. F. Bartsch, C. Frank, and S. Peterson, National Environmental Research Center, EPA Corvallis, OR

Report summarized major segments of research activities that the U.S. Environmental Protection Agency has completed or now has under way that relate to nitrilotriacetate, viruses, disinfection of municipal wastewater and the effects of poly-chlorinated biphenyls on fish and fish products. Summary highlights research areas which may have impact on objectives of the International Joint Commission and recommended in its 1973 annual report and should not be considered inclusive of all activities presently funded by EPA in the above subject areas.

NEW REPORT ABSTRACTS SECTION

670/2-73-077 PE 1BB034 IN-HOUSE PROJECT

Combined Sewer Overflow Seminar Papers Edison Water Quality Laboratory, EPA Edison, NJ

The U.S. Environmental Protection Agency in conjunction with the New York State Department of Environmental Conservation conducted three one-day siminars on the problem of wet-weather flow pollution abatement. Many facets of the problem were considered including a brief overview of its magnitude and what the federal government is doing to manage and control this source of pollution. Various management, control, and treatment techniques were described and the most up-to-date information on design and economics was presented. The audience consisted of consulting and municipal engineers from all areas of New York State. This publication is a compilation of the papers presented at the siminar.

670/2-74-003 PE 1BB040 ROAP/TASK 21 AGC 004 CONTRACT NO. 68-03-0268

Mine Drainage Pollution Control Demonstration Grant Procedures and Requirement BY F. J. Zavol, and R. Burns, Cyrus Wm. Rice Division, NUS Corporation Pittsburgh, PA

This report is a presentation of procedures and requirements for use by all individuals considering or participating in Section 107 grant demonstration projects authorized by Federal Water Pollution Control Act Amendments of 1972. It provides an interpretation of Section 107, defines the procedures and requirements for grant applicants, and discusses all phases of demonstration projects, including monitoring requirements and reports. EPA CONTACT: Harris, E. F. 513-684-4417

670/2-74-035A PE 1DB314 ROAP/TASK 02 AAE 004 GRANT NO. 801289

First Annual Report: Routing of Solid Waste Collection Vehicles and Appendix A – A Linear Programming Approach for the Traveling Salesman Problem BY M. Wathne, Illinois, University of Urbana, IL

The first report provides the background for routing solid waste collection vehicles. Problems encountered with existing methods and possible solutions are given. Appendixes A and B are solutions to two classic routing problems. Appendix A takes the integer programming formulation of Dantzig, Fulkerson, and Johnson which is relaxed to a linear program and a column generation scheme found for its dual. A matching constraint is then added to eliminate some of the fractional solutions which contain an odd cycle of noninteger edges. Finally, a branch-and-bound scheme is employed to search for an optimal all-integer solution. Appendix B (separately bound) is a study applying network theory to the problem of routing a solid waste collection vehicle through a street network. The total length of the tour is sought rather than the detailed and chronologic schedule of the vehicle. This tour is found by minimizing the total length of street segments which have to be retraced. The problem can be described mathematically as a linear program whose optimal solution is guaranteed to be integer. Due to the size of the problem, linear program algorithms cannot be used.

670/2-74-035B PE 1DB314 ROAP/TASK 02 AAE 004 GRANT NO. 801289

First Annual Report: Routing of Solid Waste Collection Vehicles and Appendix B – Optimal Routing of Solid Waste Collection Vehicles BY S. Hong, Illinois, University of Urbana, IL

The first report provides the background for routing solid waste collection vehicles. Problems encountered with existing methods and possible solutions are given. Appendixes A and B are solutions to two classic routing problems. Appendix A takes the integer programming formulation of Dantzig, Fulkerson, and Johnson which is relaxed to a linear program and a column generation scheme found for its dual. A matching constraint is then added to eliminate some of the fractional solutions which contain an odd cycle of noninteger edges. Finally, a branch-and-bound scheme is employed to search for an optimal allinteger solution. Appendix B is a study applying network theory to the problem of routing a solid waste collection vehicle through a street network. The total length of the tour is sought rather than the detailed and chronologic schedule of the vehicle. This tour is found by minimizing the total length of street segments which have to be retraced. The problem can be described mathematically as a linear program whose optimal solution is guaranteed to be integer. Due to the size of the problem, linear program algorithms cannot be used.

670/2-74-036A PE 1DB314 ROAP/TASK 02 AAE 004 GRANT NO. 801289

Routing of Solid Waste Collection Vehicles, Final Report: Appendix A – Manual for Use of the Computer Codes BY J. C. Liebman, Illinois, University of Urbana, IL

This report describes research on computer-based and manual techniques for the routing of solid waste collection vehicles. Algorithms are given for the routing of single vehicles under three conditions: (1) all streets are two way, (2) all streets are one way, and (3) some streets are two way and others are one way. In addition, a heuristic algorithm is provided for routing several vehicles in a larger area. Appendix A is a manual for use of the computer codes. Appendix B (separately bound) is a heuristic solution to the m-postmen's solution.

670/2-74-036B PE 1DB314 ROAP/TASK 02 AAE 004 GRANT NO. 801289

Routing of Solid Waste Collection Vehicles: Appendix B – A Heuristic Solution to the M-Postmen's Problem BY J. W. Male, Illinois, University of Urbana, IL

This report describes research on computer-based and manual techniques for the routing of solid waste collection vehicles. Algorithms are given for the routing of single vehicles under three conditions: (1) all streets are two way, (2) all streets are one way, and (3) some streets are two way and others are one way. In addition, a heuristic algorithm is provided for routing several vehicles in a larger area. Appendix A is a manual for use of the computer codes. Appendix B is a heuristic solution to the m-postmen's solution.

NEW REPORT ABSTRACTS SECTION

670/2–74–076a PE 1DB064 ROAP/TASK 24 ALA 002 GRANT NO. 801282

Experimental High Ash Papermill Sludge Landfill – First Annual Report BY O. B. Andersland, R. P. Vallee, and T. A. Armstrong, Michigan State University East Lansing, MI

An experimental papermill sludge landfill was constructed and monitored to obtain engineering information essential to the development of guidelines and recommendations for the design and operation of solid papermill waste landfills. The experimental landfill consisted of two sludge layers, with sand drainage blankets, an earth dike for lateral confinement and a natural soil cover. The landfill was instrumented for settlement, water pressure, vertical and lateral earth pressure, temperature, sludge unit weights, specific gravity, and water contents. Laboratory work was also conducted. A detailed description of the field behavior is given in the report along with predictions based on laboratory results and soil mechanics theory. Sampling of leachate from the sludge landfill at weekly intervals and laboratory analysis according to standard methods for the examination of water and wastewater provided documentation as to leachate composition. A lysimeter study provides information of changes in quality of the leachate when passed through selected natural soils. EPA CONTACT: Schomaker, N. B. 513–684–4487

670/2–74–076b PE 1DB064 ROAP/TASK 24 ALA 002 GRANT NO. 801282

Experimental High Ash Papermill Sludge Landfill – Second Annual Report BY O. B. Andersland, R. P. Vallee, W. A. Charlie, and D. W. Marshall, Michigan State University East Lansing, MI

The second annual report investigated slope stability by removal of one dike from the sludge landfill. The landfill was excavated to form a 3:4 slope and trimmed to 1:8 slope. Prior to construction, vane shear strength and Dutch cone resistance data were obtained. Slope indicator and piezometers were installed. Laboratory studies and analysis were also conducted. Leachate sampling and analysis documented changes occurring during the project period. EPA CONTACT: Schomaker, N. B. 513–684–4487

670/2–74–079 PE 1BB034 ROAP/TASK 21 ASY 032 GRANT NO. 11020 FAM

Evaluation of Three Combined Sewage Overflow Treatment Alternatives BY J. W. Parks, Shelbyville, City of Shelbyville, IL

An evaluation of the performance of three different combined sewer overflow treatment units is presented, with influent and effluent flow, BOD, and suspended solids data for a single-cell flow-through lagoon; a retention lagoon followed by a two-cell facultative lagoon system and effluent chlorination; and a sedimentation tank with influent chlorination. The extent of preconstruction pollution from combined sewer overflow is discussed as well as the success of partial sewer separation in reducing the strength of combined sewer overflow. The performance of the two-cell facultative lagoon as a tertiary treatment system for the existing sewage treatment plant effluent is also analyzed in detail, demonstrating a dual use for this type of combined sewer overflow treatment unit. Each of the three treatment alternatives were found to provide substantial reduction in combined sewer overflow pollution, with the lagoon units giving the greater removal efficiencies. Specific recommendations for additional study and evaluation are offered. EPA CONTACT: Cesares, D. 201–548–3546

670/2–74–083 PE 1DB063 ROAP/TASK 02 AAE 006 GRANT NO. 800055

Analysis of the Current Impact of Plastic Refuse Disposal Upon the Environment BY D. A. Braughan, M. Y. Anastas, and H. H. Krause, Battelle Columbus Laboratories Columbus, OH

In view of the 7-fold growth in the amount of plastic waste over the past 20 years the impact of plastic refuse disposal upon the environment has been evaluated on the basis of the major current methods of disposal, municipal incineration, landfill and litter. While weight percentage of the plastic component may tend to be used to evaluate its contribution to the environmental impact via incineration the volume percentage of plastics is more important with respect to its contribution to landfill, both sanitary and open dump with and without burning. A useful life analysis of plastic products is described which quantifies the amounts of plastic waste by type. EPA CONTACT: Oberacker, D. A. 513–684–4493

670/2–74–084 PE 1DB063 ROAP/TASK 24 ALL 019 GRANT NO. 800055

Study of Corrosion in Municipal Incinerators Versus Refuse Composition BY D. A. Braughan, H. H. Krause, and W. W. Boyd, Battelle Columbus Laboratories Columbus, OH

Fireside corrosion resulting from the combustion products of municipal and industrial refuse is a severe problem to solid waste disposal by incineration in water-wall furnaces, and/or where heatrecovery systems are employed. Furthermore with advances in recycling and resource recovery the composition of the burnable portion of the refuse will be altered. Hence, a study was made of the effects of refuse composition on fireside corrosion of nine alloys and two protective coating materials to develop a better understanding of corrosion in solid waste incinerators. The refuse compositional variables investigated were chlorine, which was introduced through the addition of polyvinyl chloride (PVC), and sulfur, which was added in the elemental state. Air-cooled probes exposed to the resulting combustion environments were analyzed for corrosion rates and for deposit composition. Also, the combustion gases were monitored. EPA CONTACT: Oberacker, D. A. 513–684–4493

670/2–74–087 PE 1BB034 ROAP/TASK 21 ASY 038 CONTRACT NO. 68–03–0262

Assessment and Development Plan for Monitoring of Organics in Storm Flows BY A. E. Molvar, and A. Tulumello, Raytheon Company Protsmouth, RI

Sewer line scouring, urban runoff, and combined sewage associated with storm events represent a substantial organic pollution load. Since storms usually exhibit high flow rates over a short period of time, the treatment facilities become overloaded and deliver an organic pollution load to receiving water bodies. Many times a significant amount of the combined sewage bypasses the treatment plant and is discharged untreated. A method for assessing the organic content of storm related wastewaters would permit programming discharges, and monitoring and controlling treatment processes. Experience with currently available commercial TOC units has not resulted in a sense of confidence in the hardware. Tests are presently underway to establish sample processing, modifications of the engineering model, and accumulation of the continuous monitoring data on total organic carbon content of storm and combined sewage. EPA CONTACT: Masters, H. E. 201–548–3541

NEW REPORT ABSTRACTS SECTION

670/2–74–090 PE 1BB034 ROAP/TASK 21 ASY 001 IN-HOUSE PROJECT

Countermeasures for Pollution From Overflow – The State of the Art BY R. Field, and J. A. Lager, National Environmental Research Center, EPA Cincinnati, OH

Control and/or treatment of stormwater discharges and combined sewage over-flows from urban areas are problems of increasing importance in the field of water quality management. Over the past decade much research effort has been expended and a large amount of data has been generated. Presented in this text are selected results of a comprehensive investigation and assessment of promising, completed and ongoing projects, representative of the state-of-the-art in abatement theory and technology; a look at recent legislation; and the identification of program needs and emphasis. Full text published by EPA September 1974 under title "State of the Art – Urban Stormwater Management and Technology: An Assessment" EPA-670/2–74–040. EPA CONTACT: Lederman, P. 201–548–3503

670/2–74–091 PE 1BB038 ROAP/TASK 21 APK 018 CONTRACT NO. 68–01–0115

Devices for On – Board Treatment of Waste from Vessels BY T. J. O'Grady, and T. D. Lakomski, Thiokol Corporation Brigham City, UT

A program involving the demonstration of a pleasure craft zero discharge, physical/chemical waste treatment system employing a unique filter-incinerator device was conducted. Extensive test data from laboratory and shipboard demonstration tests of the system are presented. Data on manufacture and installation costs for the pleasure craft are also presented. The program demonstrated the ability to zero discharge waste and comply with the 23 June 1972 EPA no-discharge standard. This report was submitted in fulfillment of Contract 68–01–0115, under the sponsorship of the Environmental Protection Agency. EPA CONTACT: Mc Carthy Jr., L. T. 201–548–3549

670/2–74–092 PE 1BB038 ROAP/TASK 21 APO 008 CONTRACT NO. EHS 70–108

Crankcase Drainage from In-Service Out-board Motors BY C. P. Hare, and C. J. Pringer, Southwest Research Institute San Antonio, TX

Crankcase drainage from 35 outboard motors was measured during normal operation on two lakes in the San Antonio area. The motors included a variety of sizes and brand names, and they were tested under prolonged constant-speed conditions as well as cyclic speed conditions designed to simulate user operation in the field. Four engines of the same group were also tested with a drainage intercepting and recirculating device. Drainage was measured by both mass and volume, and results were also computed in mass per unit time (g/hr) and percentage of fuel consumed by weight and by volume. Analysis of some fuel samples was conducted by gas chromatograph, including a few in which drainage was mixed with fuel by the recirculating device mentioned above. Photographic documentation of the test engines, the drainage systems, and test/measurement techniques was also obtained. Based on measurements obtained during this study and estimations on the current outboard motor population, a range for the national total crankcase drainage emissions was estimated. It was also found that the major causes of variation in drainage rates were engine type, engine operating speed, and differences from one engine to another of the same type (or a similar type). EPA CONTACT: Padden, T. J. 202–426–4188

670/2–74–095a PE 1DB314 ROAP/TASK 09 ABF 003 CONTRACT NO. 68–03–0244

Effects of Water Pollution Controls on Solid Waste Generation, 1971 to 1985: Executive Summary BY R. Stone, Ralph Stone and Company, Inc. Los Angeles, CA

The effects of air and water pollution controls on solid waste generation were evaluated. The solid wastes from pollution control were identified for individual industrial sectors by their original air or water pollutant constituents, and the treatment process applied. The wastes were categorized by type and by location (rural or urban). Total solid wastes from pollution control activities were estimated for 1971 and projected for 1985. Particulates and sulfur oxides were identified as the major air pollutants capable of generating solid wastes when treated; suspended solids and biological oxygen demand were identified as the principle means of estimating the impact of water pollution control on solid wastes. EPA CONTACT: Talley, R. J. 513–684–4484

670/2–74–095b PE 1DB314 ROAP/TASK 09 ABF 003 CONTRACT NO. 68–03–0244

Forecast of the Effects of Air and Water Controls of Solid Waste Generation BY R. Stone, and D. Brows, Ralph Stone and Company, Inc. Los Angeles, CA

The effects of air and water pollution controls on solid waste generation were evaluated. The solid wastes from pollution control were identified for individual industrial sectors by their original air or water pollutant constituents, and the treatment process applied. The wastes were categorized by type and by location (rural or urban). Total solid wastes from pollution control activities were estimated for 1971 and projected for 1975, 1980, and 1985. Particulates and sulfur oxides were identified as the major air pollutants capable of generating solid wastes when treated; suspended solids and biological oxygen demand were identified as the principle sources for the impact of water pollution control on solid wastes. EPA CONTACT: Talley, R. J. 513–684–4484

670/2–74–096 PE 1BB034 ROAP/TASK 21 ATB 014 GRANT NO. 11030 HJP

Characterization and Treatment of Urban Land Runoff BY N. V. Colston, North Carolina, University of Raleigh, NC

Urban land runoff from a 1.67 square-mile urban watershed in Durham, North Carolina, was characterized with respect to annual pollutant yield. Regression equations were developed to relate pollutant strength to hydrograph characteristics. Urban land runoff was found to be a significant source of pollution when compared to the raw municipal waste generated within the study area. On an annual basis, the urban runoff yield of COD was equal to 91 percent of the raw sewage yield, the BOD yield was equal to 67 percent, and the urban runoff suspended solids yield was 20 times that contained in raw municipal wastes for the same area. Downstream water quality was judged to be controlled by urban land runoff 20 percent of the time. In urban drainage basins, investments in upgrading secondary municipal waste treatment plants without concomitant steps to moderate the adverse effects of urban land runoff are questionable in view of the apparent relative impact of urban land runoff on receiving water quality. EPA CONTACT: Tafuri, A. N. 201–548–3512

NEW REPORT ABSTRACTS SECTION

670/2–75–001 PE 1BB043 ROAP/TASK 21 ASR 45 IN-HOUSE PROJECT

Alternative Systems for Supplying Dissolved Oxygen in Wastewater Treatment BY R. Smith, and W. F. McMichael, Advanced Waste Treatment Research Laboratory, EPA Cincinnati, OH

Various alternative systems for supplying oxygen to wastewater treatment processes were studied and evaluated in terms of cost and effectiveness. Systems which deliver atmospheric air to the process such as diffused aeration, mechanical aeration, and turbine aeration are compared to systems which deliver pure oxygen gas. The relationship between oxygen consumption and excess sludge production in the activated sludge process is quantified. Factors such as the diurnal variation in oxygen demand and the oxygen demand as a function of distance along the aerator in the activated sludge process are studied. Finally, the total cost for oxygen supply expressed as cents per pound of oxygen dissolved in the wastewater is estimated as a function of total oxygen consumption expressed as tons of oxygen used per day. The least costly system was found to be mechanical aeration. The pure oxygen system was found to cost roughly the same as a diffused air system with an aeration efficiency of 5.4%. EPA CONTACT: Smith, R. 513–684–8352

670/2–75–002 PE 1BB034 ROAP/TASK 21 ASY 37 CONTRACT NO. 14–12–0494

Suspended Solids Monitor BY J. W. Liskowitz, G. J. Francey, and J. Tarzynski, American Standards, Inc. New Brunswick, NJ

A method for measuring concentration of suspended solids in liquid media, based on depolarization of backscattered polarized light, has been developed and instrumented. Feasibility studies and field evaluation of the instrument, using sewage influent, effluent and sludge, showed that there is a specific relationship between concentration of solid particles and polarization ratio. It was also shown that the relationship is independent of size distribution and density of particles, color of particles or solution, sludge consistency, velocity, and build-up of solids on the optical window. The field evaluation results indicate that this insturument provides a continuous instantaneous *in situ* measurement of suspended solids concentrations in combined sewers and other wastewater flows. This report was submitted in fulfillment of Project No. 11024DZB, Contract No. 14–12–494 by American Standard Inc. under the sponsorship of the U.S. Environmental Protection Agency. Work was completed in August, 1970. EPA CONTACT: Field, R. 201–548–3503

670/2–75–003 PE 1BB041 ROAP/TASK 21 BEA 08 GRANT NO. 803063–01

Oil Spill and Oil Pollution Reports BY Jr., F. A DeWitt, and P. Melvin, California, University of Santa Barbara, CA

The July 1974 – October 1974 Oil Spill and Oil Pollution Reports is the first quarterly compilation of oil spill events and oil pollution report summaries. Presented in the report are: (a) summaries of oil spill events; (b) summaries and bibliographic literature citations; (c) summaries of current research projects; and (d) patent summaries. This report is submitted in partial fulfillment of EPA Grant No. R-803063 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the Environmental Protection Agency. EPA CONTACT: Dorrler, J. S. 201–548–3508

670/2–75–004 PE 1BB041 ROAP/TASK 21 AVN 22 CONTRACT NO. 68–03–0228

Feasibility of 5 gpm Dynactor/Flash Magnetic Separator System to Treat Spilled Hazardous Materials BY R. G. Sanders, S. R. Rich, and T. G. Pantazelos, Industrial Bio-Test Laboratories, Inc. Northbrook, IL

Design and operating details are given for a new type of continuous flow thin-film, gas-liquid-particulate contact device called the Dynactor. The device is used as a continuous flow short-time contact reactor to effectively decontaminate water contaminated with spilled hazardous materials. The decontamination is effectively achieved by one or more processes involving oxidation, neutralization, precipitation or adsorption on powdered carbon. Contaminated water is processed by the pilot plant model Dynactor at 100 psi and at a rate of 5 gpm; stoichiometric quantities of decontaminating agents in the form of gases, liquids, slurries or powders are metered into the continuously flowing liquid configuration. The device is portable, lightweight polypropylene construction, has no moving parts, requires a pump for liquid motive power and can be scaled up to 250 gpm of contaminated water. Design and operating details are given for continuous flow magnetic separation to remove flocculated carbon and precipitates from the Dynactor effluent after decontamination of hazardous materials. Experimental data on successful decontamination of heavy metals by precipitation, acids and bases by neutralization, phenol, chlorine and pesticides by powdered carbon adsorption and other selected hazardous compounds are presented. EPA CONTACT: Wilder, I. 201–548–3507

670/2–75–005 PE 1DB311 ROAP/TASK 07 ADZ 10 IN-HOUSE PROJECT

Degradation Mechanism: Controlling the Bioaccumulation of Hazardous Materials BY C. Rogers, and R. Landreth, Solid and Hazardous Waste Research Laboratory, EPA Cincinnati, OH

Numerous toxic and hazardous compounds are being generated for commercial, industrial and agricultural uses. Most of these materials are eventually released into the environment. This study documented the existance of biological, chemical and physical transformation processes of hazardous wastes in the environment. It was determined that the rates of transformation of these hazardous materials, when applied and/or discharged to the environment, are slow. Case studies confirmed that persistency of certain hazardous materials results in the bioaccumulation of residues in living systems. A lack of knowledge of the fate and clinical manifestation of persistant residues in living systems dictates the need for implementation of the described scheme of control technology. EPA CONTACT: Rogers, C. 513–684–4484

670/2–75–007 PE 1BB038 ROAP/TASK 21 BBU 03 CONTRACT NO. 68–03–0221

On-Shore Treatment Systems for Sewerage from Watercraft Retention Systems BY A. J. Glueckert, and P. A. Saigh, General American Transportation Corporation Niles, IL

During this program an evaporative waste treatment system for onshore treatment of sewage from watercraft retention systems was developed and demonstrated. Wastes and chemical additives associated with recreational watercraft holding tanks were characterized by analyses of sewage samples obtained from marina and watercraft retention tanks utilizing both freshwater and seawater flushed sanitary systems and by a survey of typical chemical additives employed as bacteriostatic and odor reducing agents. An evaporative waste treatment system was evaluated by testing a propane-fired evaporator for 224 hours with inhouse sewer wastes and wastes collected from

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marina holding tanks. The evaporative system treated 4,590 liters (1,212 gal.) of sewage and concentrated the total solids of the sludge from the initial 0.5% to 13.4% before servicing and removal of the concentrated sludge was required. Because the chemical additives of holding tanks caused foaming, the evaporator had to be operated at approximately 50% of its capacity; however, additives had no other deleterious effects on the evaporative system. The concentrated sludge produced in the evaporator was incinerated in a batch-type incinerator. Although the incineration of the sludge was feasible, the available incinerator was too small to handle all the sludge which could be produced by the continuously operating evaporator. EPA CONTACT: Cesareo, D. J. 201–548–3546

670/2–75–008 PE 1BB043 ROAP/TASK 21 ASR 15 IN-HOUSE PROJECT

System Alternatives in Oxygen Activated Sludge BY D. F. Bishop, S. M. Bennet, and A. B. Hais, Advanced Waste Treatment Research Laboratory, EPA Cincinnati, OH

An oxygen activated sludge system with co-current contacting of oxygen and mixed liquor in a plug flow reactor was operated on District of Columbia primary effluent during a two-year period over a wide range of loading (F/M 0.26 to 2.0) with Solids Retention Times (SRT) from 2.0 to 13.0 days at the EPA-DC Pilot Plant. EPA CONTACT: Bishop, D. F. 513–684–8353

670/2–75–009 PE 1BB033 ROAP/TASK 21 ASW 00 CONTRACT NO. 14–12–0831

Water Renovation of Municipal Effluents by Reverse Osmosis BY J. E. Cruver, J. E. Beckman, and E. Bevege, Gulf Environmental Systems Company San Diego, CA

The purpose of the work performed under this contract has been to obtain reverse osmosis operating data on primary and secondary effluents with varying degrees of pretreatment. Field tests were conducted at the Pomona Water Renovation Plant of the County Sanitation Districts of Los Angeles. Two parallel reverse osmosis systems were operated with spiral wound membrane modules. It was concluded that spiral wound reverse osmosis units can be economically operated on primary and activated-sludge effluents with only moderate pretreatment and periodic chemical cleaning. Activated-carbon pretreatment was shown to be unnecessary for successful operation on sand-filtered activated sludge or chemically clarified and sand-filtered primary effluent. A simplified economic analysis indicated that reverse osmosis treatment costs are favorable and that the process merits serious consideration in a planned water supply and waste management program. EPA CONTACT: Bostian, H. 513–684–8358

670/2–75–012 PE 1BB043 ROAP/TASK 21 ASD 16 CONTRACT NO. 68–03–0203

Lime Stabilized Sludge: Its Stability and Effect on Agricultural Land BY C. A. Counts, and A. J. Shuckrow, Battelle Memorial Institute Richland, WA

An optimum system for the lime stabilization of municipal sewage sludge was first developed and then evaluated. The primary objectives of this work were: (1) to determine the degree of stability induced in a sludge by lime addition and (2) to determine the effects of spreading lime-stabilized sludge on agricultural land. Lime doses and contact times required to eliminate the pathogenic bacteria and odors from a raw sludge were determined by laboratory studies, and the information obtained was translated into design and operational parameters for a pilot scale, continuous flow process. Physical, chemical and biological characteristics of both the raw and stabilized sludges were measured. Soil and crop studies, both in a greenhouse and on controlled outdoor plots, were performed to determine the effects of spreading lime-stabilized sludge. Effective lime stabilization of sludge was accomplished by elevating the pH to 12.0 with lime addition and maintaining this pH level for at least 30 minutes. EPA CONTACT: Smith, Jr., J. E. 513–684–8267

670/2–75–013 PE 1BB043 ROAP/TASK 21 ASD 27 IN-HOUSE PROJECT

Interim Report of Task Force on Phosphate Removal Sludges BY J. B. Farrell, Advanced Waste Treatment Research Laboratory, EPA Cincinnati, OH

Information on dewatering properties of municipal wastewater sludges is scant and poorly organized. A Task Force has collected information on wastewater sludges with particular emphasis on sludge produced when lime, Fe^{+++}, or AL^{+++} are added for the purpose of P removal to some portion of the wastewater treatment sequence. Data are presented on the thickening and dewatering characteristics of the sludges. Most of the information relates to the mass of sludge produced and its filtering properties. Sludges produced when lime is added to wastewater have greater solids content after settling and dewater at greater mass rates than conventional sludges. However, mass of sludge per volume of wastewater is greatly increased. Considerable information is available on such sludges. Sludges produced when AL^{+++} or Fe^{+++} is added to wastewater dewater more poorly than conventional sludges and sludge solids content is less. Sludge mass is greater than in conventional treatment but not as great as would be produced by lime addition. Information is clearly not yet adequate for accurately predicting dewatering properties of such sludges. Research studies and field investigations of the dewatering properties of the sludges produced by adding AL^{+++} and Fe^{+++} to wastewater are being continued. EPA CONTACT: Farrell, J. B. 513–684–8265

670/2–75–017 PE 1BB034 ROAP/TASK 21 ATA 22 GRANT NO. 802411

Storm Water Management Model: User's Manual – Version II BY W. C. Huber, J. P. Heaney, M. A. Medina, W. A. Peltz, H. Sheikh, and G. F. Smith, Florida, University of Gainesville, FL

A comprehensive mathematical model (the EPA Storm Water Management Model, SWMM) capable of representing urban stormwater runoff and combined sewer overflow phenomena was developed. SWMM portrays correctional devices in the form of user-selected options for storage and/or treatment with associated estimates of cost. Effectiveness is portrayed by computed treatment efficiencies and modeled changes in receiving water quality. The original project report published in 1971 is divided into four volumes: Volume I, "Final Report"; Volume II, "Verification and Testing"; Volume III, "User's Manual"; and Volume IV, "Program Listing" (EPA Report Nos. 11024DOC07/71, 1102DOC08/71, 11024DOC09/71, and 11024DOC10/71, respectively.) Effort on modification and improvement of the SWMM has been, and is being continued since its release. As a result, this official "Release 2" of the SWMM includes additional program components, i.e., new runoff routine, urban erosion prediction, new treatment process performance and cost functions, and new receiving water quality. This report provides a revised and improved User's Manual to accompany "Release 2" as in the original User's Manual, Volume III. EPA CONTACT: Fan, C. Y. 201–548–3419

NEW REPORT ABSTRACTS SECTION

670/2–75–024 PE 1DB064 ROAP/TASK 24 ALH 06 CONTRACT NO. 68–03–0123

Industrial Solid Waste Classification Systems BY J. B. Berkowitz, F. March, and R. Horne, Arthur D. Little, Inc. Cambridge, MA

A Classification system for industrial processing wastes was developed based on waste stream characteristics, materials components, and chemical composition. An associated inventory form was devised for systematic reporting of a variety of waste descriptors including physical form, composition, methods of handling, treatment and disposal, and potential for reuse. The system was developed by literature review, consultations, and site visits. It is intended for application to industrial waste surveys and to the preparation of statiscal summaries of parameters pertinent to solid waste management. The system is adaptable to computer storage and retrieval of information related to reuse potential and disposability of industrial wastes. It is designed to cover all industries of the SIC codes, and has been tested on a broad representation of processing waste streams in a large number of industries. EPA CONTACT: Carnes, R. A. 513–684–4487

670/2–75–025 PE 1DB063 ROAP/TASK 24 ALL 03 IN-HOUSE PROJECT

High-Temperature Vortex Incinerator BY R. C. Thurnau, and D. A. Oberacker, Solid and Hazardous Waste Research Laboratory, EPA Cincinnati, OH

This study was designed to help fill the gap between antiquated incinerators and the solid waste problem. Work was initiated on a new type of incinerator—a high-temperature vortex incinerator. The project was sponsored by the U.S. Environmental Protection Agency, National Environmental Research Center-Cincinnati, Solid and Hazardous Waste Research Laboratory. Specifically, the incinerator was designed and built at the Center Hill Pilot Plant of SHWRL and used only untreated municipal waste as its fuel. EPA CONTACT: Thurnau, R. C. 513–684–8414

670/2–75–026a PE 1DB314 ROAP/TASK 02 AAE 03 GRANT NO. 801633

Analysis Models for Solid Waste Collection BY J. F. Hudson, D. S. Grossman, and D. H. Marks, Massachusetts Institute of Technology Cambridge, MA

Analytic models are developed as aids in decision-making at many points in the solid waste collection and haul system. Models for daily operating policy include breakdown or excess load, maintenance and stochastic influences such as weather. Longer range issues include choosing a level of service and the implications upon equipment, crew size, and work rules of such a decision. The primary thrust of the report develops an econometric model for prediction of waste output from census data and then districts into daily collection areas. A computer based districting methodology is outlined; an easily applicable heuristic for routing trucks within the districts was also developed. Actual data from Brookline, Massachusetts, serves in a sample application of the proposed models. Finally, on the regional level, a Linear Programming Model for equitable and efficient system design has been realized. All models are designed as management tools for public collection from residences and include discussion of appropriate extensions to commercial and industrial collection and haul. EPA CONTACT: Oberacker, D. A. 513–684–4484

670/2–75–026b PE 1DB314 ROAP/TASK 02 AAE 03 GRANT NO. 801633

Analysis Models for Solid Waste Collection BY J. F. Hudson, D. S. Grossman, and D. H. Marks, Massachusetts Institute of Technology Cambridge, MA

Analytic models are developed as aids in decision-making at many points in the solid waste collection and haul system. Models for daily operating policy include breakdown or excess load, maintenance and stochastic influences such as weather. Longer range issues include choosing a level of service and implicatons upon equipment, crew size, and work rules of such a decision. The primary thrust of the report develops an econometric model for prediction of waste output from census data and then districts into daily collection areas. A computer based districting methodology is outlined; an easily applicable heuristic for routing trucks within the districts was also developed. Actual data from Brookline, Massachusetts, serves in a sample application of the proposed models. Finally, on the regional level, a linear programming model for equitable and efficient system design has been realized. This second volume contains documentaion of the computer programs used and developed in the course of the work as well as the appendices to the main volume. EPA CONTACT: Oberacker, D.A. 513–684–4484

670/2–75–027 PE 1BB043 ROAP/TASK 21 AST 05 GRANT NO. WPRD 4–01–67

Reverse Osmosis of Treated and Untreated Secondary Sewage Effluent; Appendix A-2 and Appendix A-6 BY D. F. Boen, and G. L. Johannsen, Eastern Municipal Water District Hemet, CA

The two appendices in this volume complete report "Reverse Osmosis of Treated and Untreated Secondary Sewage Effluent", EPA 670/2–74–077; the following abstract is that for the main volume. A pilot study was conducted to determine reverse osmosis feasibility on untreated and treated secondary effluents. Six commercially designed reverse osmosis pilot units, with 3,000 to 10,000 GPD nominal capacities and different module concepts, were tested. Post treatment of secondary effluent feeds, using alum clarification, sand filtration, granular activated carbon treatment, chlorine additions and pH adjustment, in different combinations improves reverse osmosis performance and significantly extends useful membrane life. Membrane fouling occurs despite post secondary effluent treatments. Enzymatic detergent solutions were moderately effective as membrane rejuvenation treatments. Inorganic fouling (particularly with phosphates) could be removed with solutions of the sodium salt of ethylenediaminetetraacetic acid. Of the module concepts tested, one of the tabular makes and the spiral wound had the best overall costs, excluding brine disposal, is estimated to be $0.73/1,000 gallons for 9 MGD product water facility. EPA CONTACT: Stern, G. 513–684–8276

670/2–75–029 PE 1BB036 ROAP/TASK 21 AZD 23 GRANT NO. 803226–01

Copper Recovery from Brass Mill Discharge by Cementation with Scrap Iron BY P. O. Case, Anaconda Company Waterbury, CT

This report presents the results of studies of copper recovery (and incidental reduction of hexavalent chromium) in brass mill discharge by passage of the discharge over scrap iron in a rotating drum. The drum feed consisted of normal production discharge of combined pickle rinse water and spent sulfuric acid and sulfuric acid-bichromate pickle. About half of the total mill waste discharge over a period of 16 weeks was processed. Four modes of drum operation were studied: (1) continuous rotation, (2) no rotation, (3) intermittent rotation (1 hr off – 5 min on), and (4) intermittent rotation (2–1/2 hr off – 10 min on). Each mode was studied at two flow levels and two scrap iron surface area levels. Data were evaluated in terms of percent cementation of available copper, excess iron consumption over theoretical, and completeness of chromium reduction. Results indicate that the over-riding factor in the efficiency of copper cementation is the level of copper in the feed solution. Hexavalent chromium is effectively reduced providing the pH is below 2.5. EPA CONTACT: Tabakin, R. B. 201–548–3414

NEW REPORT ABSTRACTS SECTION

670/2–75–030 PE 1DB064 ROAP/TASK 02 AAE 05 GRANT NO. 800938

Urban Street Cleaning BY A. H. Levis, Polytechnic Institute of Brooklyn Brooklyn, NY

This report presents the results of the analysis of mechanized street cleaning in urban areas. It includes the description of a data bank that contains detailed information on a blockside basis for a 300 block area. On the basis of these data the strong interrelationship between sweeper routes and no-parking regulations is established. It is then shown that the effectiveness of street cleaning by mechanical brooms is limited by the presence of illegally parked cars along curbs. Analytical models that assess the degradation of performance are developed for both metered and non-metered zones, and for any distribution of illegally parked cars. A model that relates enforcement to expected level of compliance is developed and validated with actual data. The effects of deterministic and random enforcement policies are analyzed, and a class of implementable policies that yields satisfactory results is presented. Optimal feedback policies that tend to minimize the cost of manpower while maximizing the level of compliance are derived. These results are used to determine routes and schedules that increase the effectiveness of enforcement officers. A litter generation model based on the System Dynamics methodology is developed and used to evaluate different operation conditions for commercial and residential areas. EPA CONTACT: Oberacker, D. A. 513–684–4484

670/2–75–031 PE 1DB314 ROAP/TASK 24 AIN 26 GRANT NO. 800688

Solid Waste Conversion: Cellulose Liquefaction BY J. A. Kaufman, and A. H. Weiss, Worcester Polytechnic Institute Worcester, MA

An extensive survey of the state-of-the-art in cellulose liquefaction and its chemistry, and the process concept is detailed and related to pyrolysis. Material with a heating value close to that of wood was used to make oxygen, nitrogen, and sulfur free oil having a heating value in the vicinity of 10,000 cal/gm. Cellulose liquefaction process is a continuous hydro cracking process, based on technology which is readily available from the petroleum industry, although not previously applied to solid waste. The process envisioned uses a carrier oil in which the solid waste feed is slurred. The advantage of using an oil carrier is that a liquid reaction medium is present which does not present a critical tempperature problem and the attenuant requirement of high operating pressures. Water plays an intrinsic part in the reaction for the in-site production of hydrogen. Equilibrium calculations indicate that hydrogen is the preferable reactant gas. The effects of catalyst, temperature, pressure and reaction time were correlated and catalyst optimized by simple butch and continuous experimentation. Data from a continous reactor were used to make economic projections for a 36 ton/day unit. EPA CONTACT: Schomaker, N. B. 513–684–4484

670/2–75–032 PE 1DB314 ROAP/TASK 21 BPS 15 GRANT NO. 801944

Fabrication of Single Cell Protein From Cellulosic Wastes BY W. H. Daly, and Jr., L. P Ruiz, Louisiana State University Baton Rouge, LA

Techniques to produce a protein isolate from a cellulolytic bacteria were researched with the intent of producing a potential human food supplement. The use of chemical additives which cause the cells to flocculate enabling them to be removed from the fermentation media by desludging centrifuge offers an inexpensive means of cell harvesting. Several flocculating agents which are effective at a concentration of 0.1% for flocculating *Cellulomonas* are reported. The addition of food grade proteins followed by a pH adjustment offers an alternative to chemical flocculation. In addition, acid and alkaline hydrolysis to remove nucleic acids from the bacterial protein was investigated. EPA CONTACT: Rogers, C. J. 513–684–4484

670/2–75–035 PE 1BB034 GRANT NO. 11022 FLV

Stream Pollution Abatement by Supplement Pumping BY C. W. Rsh, and W. W. Sadler, Richmond, City of Richmond, VA

At the Richmond, Virginia, Wastewater Treatment Plant, a major structure, i.e., a Supplemental Pumping Station, and several ancillary structures were provided to achieve the project objective of no bypassing while a new grit chamber was being connected ahead of the existing Main Pumping Station, which station received and pumped all of the raw sewage. The Supplemental Pumping Station was constructed by sinking a two-compartment, sheet steel cofferdam around an existing 72-inch concrete sewer and rearranging the effluent sewer flow pattern so that the sewage was redirected to the site of the Supplemental Pumping Station. The redirection of sewage flow was achieved by the reconstruction of a junction chamber and by the insertion of a specially designed removable bulkhead, all without bypassing sewage. The time required for the design, construction and operation of the Supplemental Pumping Station was about 36 months and the cost of this project was approximately $900,000. EPA CONTACT: Brunner, C. A. 513–684–8305

670/4–74–006 PE 1BA027 ROAP/TASK 05 AEF 005 IN-HOUSE PROJECT

Taxonomy and Ecology of Aspenonena Mayflies of the Ohio River Basin BY P. A. Lewis, National Environmental Research Center, EPA Cincinnati, OH

This manual provides keys and descriptions of all North American species of *Stenonema* mayflies and consolidates information from the literature on their ecology, environmental requirements, and pollution tolerance. Accounts of each species include synonymy, nymphal description, collection records, and a distribution map. The 31 species described and keyed include three recently described species, four new synonyms, two resurrected species, and new combinations involving three additional species and subspecies. Twelve species and one subspecies are classified as intolerant to organic pollution, eight species as tolerant of mild pollution, and seven species and two subspecies as tolerant to moderate pollution. EPA CONTACT: Lewis, P. A. 513–684–2980

670/4–75–001 PE 1HA327 ROAP/TASK 24 ALE 03 IN-HOUSE PROJECT

Performance of the OSCO Model 1391 Water Wastewater Sampler BY R. P. Lauch, Methods Development and Quality Assurance Research Laboratory, EPA Cincinnati, OH

Performance of the ISCO model 1391 water sampler was tested. Tests were run at 2, 19, and 35C to check accuracy and precision of the timer, flowmeter, and sample volumes. The multiplexer function of delivering multiple aliquots per bottle was tested. Performance checks were made on both converter and battery power, and battery endurance was determined. Discrete sample temperatures were recorded versus time under iced conditions. Manufacturer's claims were mostly confirmed, but improvement is warranted for some sampler components. EPA CONTACT: Lauch, R. P. 513–684–2935

NEW REPORT ABSTRACTS SECTION

670/4–75–002 PE 1HA327 ROAP/TASK 01 AAD 10 IN-HOUSE PROJECT

Interfacing a 24-Point Analog Recorder to a Computer Controlled Telemetry Line BY J. M. Teuschler, Methods Development and Quality Assurance Research Laboratory, EPA Cincinnati, OH

Interface circuitry was designed so that telemetered data originating from various remote stations could be recorded by both a digital computer and an analog recorder. The entire interface circuitry is mounted on a 3–1/2 x 2–1/2 inch printed circuit card and installed in the receiver. Data from the two methods of collection can, therefore, be collected and a comparison can be made. A switching network also permits computer control with computer and recorder logging; or computer logging only; or recorder logging only. EPA CONTACT: Teuschler, J. M. 513–684–2918

670/4–75–003 PE 1HA327 ROAP/TASK 24 ALE 04 IN-HOUSE PROJECT

Application and Procurement of Automatic Wastewater Samplers BY R. P. Lauch, Methods Development and Quality Assurance Research Laboratory, EPA Cincinnati, OH

Application and procurement of automatic sampling devices are discussed. Different sampler characteristics including compositing, proportionality, preservation, lift, and power are described. Manufacturers are listed. Application is discussed with reference to compliance with the National Pollutant Discharge Elimination System permit program, treatment plant control, and other uses. Method of selection and procurement (involving application, familiarization, and purchase) are discussed. EPA CONTACT: Lauch, R. P. 513–684–2935

670/4–75–004a PE 1HA327 ROAP/TASK 24 AEL 06 IN-HOUSE PROJECT

Fortran Programs for Analyzing Collaborative Test Data: Part I General Statistics BY E. C. Julian, Methods Development and Quality Assurance Research Laboratory, EPA Cincinnati, OH

A FORTRAN program for IBM 1130 is described by which general statistics on interlaboratory studies of chemical analytical methods may be obtained. Data screening followed by a statistical t-test for identifying outliers is included. A histogram of data in ascending order is provided. EPA CONTACT: Julian, E. C. 513–684–2985

670/4–75–004b PE 1HA327 ROAP/TASK 24 AEL 06 IN-HOUSE PROJECT

Fortran Programs for Analyzing Collaborative Test Data: Part II Scatter Plots BY E. C. Julian, Methods Development and Quality Assurance Research Laboratory, EPA Cincinnati, OH

A FORTRAN program for IBM 1130 designed to plot three pairs of data sets in three scatter diagrams on one page is described. These data stem from interlaboratory studies of chemical analytical methods. EPA CONTACT: Julian, E. C. 513–684–2985

670/5–74–006 PE 1DA312 ROAP/TASK 24 ABV 018 GRANT NO. EP-01030

Criteria for Regional Solid Waste Management Planning BY B. H. Stevens, Regional Science Research Institute Philadelphia, PA

This report consists of a collection of studies on selected aspects of the problem of regional solid waste management planning. The research efforts fall into three main subject areas: the economics of solid waste generation recycling, and disposal, the economic and social effects of landfills, and the issues involved in local intergovernmental cooperation for regional solid waste management. The individual studies are the following: "A Framework for Evaluating the Economic Effects of Regional Solid Waste Systems", "Production Functions for Solid Waste Disposal", "Solid waste Generation Coefficients: Manufacturing Sectors", "Solid Waste Generation Coefficients: Non-Manufacturing Sectors", "Perceptions of Landfill Operations Held by Nearby Residents", and "Efforts at Intermunicipal Cooperation for Solid Waste Disposal: Why They Fail". The report also includes a summary of the studies. EPA CONTACT: Talley, R. J. 513–684–4484

670/5–75–001 PE 1DA312 ROAP/TASK 24 ABU 04 CONTRACT NO. 68–03–0193

Evaluation of Feasibility and Economic Implication of Pricing Mechanisms in Solid Waste Management BY E. Ernst, ABT Associates, Inc. Cambridge, MA

This study analyzes the potential of pricing mechanisms in solid waste management systems. Such pricing mechanisms have been suggested as appropriate means for encouraging greater efficiency of resource, both within the solid waste management system proper and among sources of solid wastes. The study reviews the limited empirical evidence concerning supply and demand characteristics in markets for solid waste management (primarily collection) services. The analysis of processing and disposal and ancillary SWM services is hampered by the diversity of existing systems, and remaining problems in the conceptual clarification of the services provided. The analysis of cost functions in the Collection and Transportation subsystem suggests that these cost functions are subject to variable returns to scale. For smaller communities, there are economies off scale with respect to the amount of waste handled. For larger communities, scale effects vanish. The available literature provides sufficiently strong evidence for the importance of both prices (and pricing policies) and incomes as determinants of the amount of waste collected per household. This evidence is used in an exploratory numerical analysis employing decision-theoretic elements to assess the likely impact of pricing mechanisms. The analysis suggests that total system costs could be reduced through pricing mechanisms, even though there would be a tendency to rely more on self-disposal as prices for collection services increase. The study concludes with a brief suggestion for a feasible method for implementing an effective pricing mechanism in SWM systems. EPA CONTACT: Goddard, H. C. 513–684–4484

NEW REPORT ABSTRACTS SECTION

670/9-74-006 **PE 1RA103** **IN-HOUSE PROJECT**

Pollution Control Technology Assessment – Proceedings of an Environmental Resources Conference, May 1–3, 1974 Battelle Columbus Laboratories Columbus, OH

A Compilation of papers presented at the third of a series of conferences on environmental matters cosponsored by the National Environmental Research Center — Cincinnati (USEPA) and the Columbus Laboratories of Battelle Memorial Institute, Columbus, Ohio. The conference subject area concerned a multifaceted assessment of water pollution control technology. Session topics included legislative mandates and standards, control technology, activities indirectly affecting water pollution control, an assessment full use of water pollution control technology. EPA CONTACT: Gigliotti, G. M. 513–684–4484

670/9-75-001 **PE 1RA103** **IN-HOUSE PROJECT**

Environmental Research Publications 1971–1975 Technical Information Staff, NERC Cincinnati, OH

This list of Publications has been created to announce reports and publications of the U.S. Environmental Protection Agency's National Environmental Research Center (NERC) in Cincinnati. This literature reports on results of scientific and engineering studies on pollution control technology performed by intramural activities of the NERC Cincinnati laboratories by cooperative activities with research and industrial organizations through contracts and grants. This publication is not intended to be a complete reference of all the technical publications of the U.S. Environmental Protection Agency. Rather, it is a selected list of those publications from the National Environmental Research Center in Cincinnati. EPA CONTACT: Gigliotti, G. M. 513–684–8259

670/9-75-003 **PE 1RA103** **IN-HOUSE PROJECT**

News of Environmental Research in Cincinnati, January – December 1974 Technical Information Staff, NERC Cincinnati, OH

A series of reports on the following subjects: impact of environmental control technologies on the energy crisis; publications – 1973; advanced wastewater treatment plant at Piscataway, Maryland; identifying organic pollutants in water; survival of fecal coliforms and fecal streptococci in a sanitary landfill; sludge incineration and fuel conservation; producing protein while reducing waste; toxicity of wastewater disinfectants; BGM: a new cell line for recovering viruses from water; radiorespirometry: rapid toxicological screening of environmental pollutants; a swirl device for regulating and concentrating combined sewer overflows; recreational water quality criteria; granular media filtration of secondary effluent; and coal refuse disposal in the Eastern United States. EPA CONTACT: Gigliotti, G. M. 513–684–8258

670/9-75-004 **PE 1BB043** **ROAP/TASK 21 ASR 119** **GRANT NO. 803294**

Upgrading Wastewater Stabilization Ponds to Meet New Discharge Standards BY E. J. Middlebrooks, D. H. Falkenborg, R. F. Lewis, and D. J. Ehreth, Utah State University Logan, UT

The question as to whether lagoons, as they now exist, meet the new secondary treatment standards and what methods would work to upgrade lagoon treatment in cases where they presently do not meet the standards is of high priority for many Regional Offices of EPA. The symposium was held for EPA staff and State Officials to review the Office of Research and Development's program for upgrading lagoons. The intermittent sand filter, land application of algae laden effluents and the submerged rock filter offer good potential for cost effective upgrading. The basic biology of the treatment mechanism, disinfection technology, the controlled discharge operation (and results), cost effective analysis, and new fields of research were covered by speakers. Intermittent sand filtration, submerged rock filtration, and land application of sewage effluents are effective alternatives to removing algae from sewage lagoons.

680/4-75-001 **PE 1HA325** **IN-HOUSE PROJECT**

Handbook of Radiochemical Analytical Methods BY F. B. Johns, National Environmental Research Center, EPA Las Vegas, NV

A compilation of the chemical procedures used at the National Environmental Research Center-Las Vegas for determining stable elements and radionuclides in environmental surveillance samples. It supersedes "Southwestern Radiological Health Laboratory Handbook of Radiochemical Analytical Methods" published as Report No. SWRHL-11 in March 1970. It should be noted that the procedures in the current compilation are intended for use in processing relatively large numbers of samples in the shortest possible time for environmental radiological surveillance and, therefore, in some cases represent a compromise between precise analytical determination and adequate determination for surveillance purposes. For historical purposes, two methods for radiostrontium in milk are included since large numbers of samples were analyzed by these methods. Appendix A provides instructions for preparing reagents listed for each method. It does not provide instructions for preparing solutions normally found in chemistry laboratories. EPA CONTACT: Johns, F. B.

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68-03-0179	670/2-74-040
68-03-0183	670/2-74-068
68-03-0193	670/5-75-001
68-03-0203	670/2-75-012

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68-03-0228	670/2-75-004
68-03-0233	660/2-73-026
68-03-0244	670/2-74-095a
68-03-0244	670/2-74-095b
68-03-0260	670/2-74-082
68-03-0262	670/2-74-087
68-03-0268	670/2-74-003
68-03-0272	670/2-75-011
GRANTS	
AP 01186	650/3-74-003
AP-01269-02	650/2-74-005
EC-0030-03	670/2-73-089A
EC-0030-03	670/2-73-089B
EP-00248	670/2-73-023
EP-00250	670/2-73-063
EP-00257	670/2-73-065
EP-00259	670/2-73-072
EP-00262-02	670/2-73-009
EP-00265	670/2-73-083
EP-00268	670/2-73-061
EP-00274	670/2-73-090
EP-00276-04	670/2-73-005
EP-00279	670/2-73-011
EP-00302	670/2-73-051
EP-00304	670/2-73-087
EP-00316	670/2-73-041
EP-00329	660/2-73-038
EP-00329	670/2-73-038
EP-00362	670/2-73-030
EP-00386	670/2-73-049
EP-00393	670/2-73-021
EP-00500-01	670/2-74-014
EP-01030	670/5-74-006
UI-00509	670/2-73-057
WP 01351-01	660/3-74-014
WP-01322-02	670/2-73-027
WPD 184-01-67	660/2-74-030
WPRD 121-01-68	670/2-73-024
WPRD 185-01-68	660/2-73-015
WPRD 23-01-68	670/2-73-098
WPRD 242-01	670/2-73-092
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WPRD 30-01-0067	670/2-73-096
WPRD 4-01-67	670/2-74-077
WPRD 4-01-67	670/2-75-027

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01EP00829	660/2-74-081
11010 ELP	670/2-73-024
11010 ENK	670/2-73-103
11010 EZQ	670/2-73-098
11010 FLQ	670/2-73-050
11010 FYM	670/2-73-033
11010 GWI	600/2-73-004
11020 FAM	670/2-74-079
11020 FAN	670/2-73-071
11020 FAX	670/2-75-020
11022 FLV	670/2-75-035
11023 EKC	670/2-75-019
11023 FAR	670/2-75-010
11023 FAS	670/2-73-067
11024 EVF	600/2-73-002
11030 HJP	670/2-74-096
11060 DRO	660/2-73-038
12010 DNF	660/2-74-050
12010 DRH	660/2-73-033
12010 FNM	660/2-73-032
12010 FXD	670/2-75-018
12040 DEH	660/2-74-069
12040 DRY	660/2-74-008
12040 EJU	660/2-75-004
12040 GQD	660/2-73-028
12040 HDU	660/2-74-086
12060 DFF	660/2-74-027
12060 DQV	660/2-73-015
12060 EGV	660/2-74-031
12060 EIG	660/2-74-088
12060 EKQ	660/2-74-012
12060 ESC	660/2-74-093
12060 ESY	660/2-74-035
12060 FAK	660/2-74-028
12060 FLL	660/2-74-014
12060 FRW	660/2-73-020
12060 FRW	660/2-73-021
12060 FYG	660/2-74-060
12060 HCW	660/2-74-059
12060 HFY	660/2-74-092
12060 HNG	660/2-74-046
12060 HPC	660/2-75-002
12070 HEK	660/2-73-023
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12090 HLO	660/2-74-039
12110 GLP	660/2-73-018
12120 FYV	660/2-73-037

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12120 HMZ	660/2-75-006
12130 DBF	660/2-73-010
12130 EKK	660/2-74-020
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12130 HRA	660/2-74-055
13020 DTV	660/2-74-005
13020 DWH	660/2-74-033
13020 EBL	660/2-74-032
13040 DFN	660/2-74-030
13040 ERR	660/2-74-009
13040 EVM	660/2-74-047
13040 FYK	660/2-74-057
14010 EFJ	670/2-73-092
14010 EFL	670/2-73-054
14010 EFN	670/2-73-093
14010 HQC	670/2-74-009
14020 EHW	660/2-74-019
14020 FVW	660/2-74-037
14040 FVD	660/2-74-018
14040 FZC	670/2-73-080
15010 PBK	670/2-73-088
15030 FMZ	660/2-73-035
15030 HIX	660/2-74-043
15080 EJQ	670/2-73-099
15080 HET	670/2-73-068
16010 DBU	660/3-74-034
16010 DCK	660/3-73-002
16010 DFI	660/3-73-001
16010 DHN	660/3-73-003
16010 EDJ	660/3-73-006
16010 EJH	660/3-73-015
16010 ELF	660/3-74-017
16010 EQQ	660/2-74-010
16020 DHD	670/2-73-079
16020 EDG	660/2-74-021
16020 EGG	660/3-74-026
16020 GIY	670/4-74-004
16030 ELZ	660/2-73-027
16040 FRL	660/2-73-008
16050 DDK	660/3-73-009
16050 DIL	660/3-73-011
16050 DXM	660/3-73-008
16050 ESP	660/3-74-002
16050 GQQ	660/3-73-025
16070 DEP	660/3-74-004a
16070 DEP	660/3-74-004b
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16070 EKZ	660/3-73-005
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16080 DYJ	660/2-74-016
16080 FBH	660/2-73-022
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16110 GEW	600/5-74-013
16130 FDQ	660/2-73-012
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16130 HKK	660/2-73-004
17010 EBM	670/2-73-027
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17030 DMA	670/2-73-074
17030 DUW	670/2-74-047
17040 DSR	670/2-74-077
17050 EEY	670/2-74-048
17060 DNU	670/2-73-029
17060 EYZ	670/2-73-082
17070 HDA	670/2-74-004
17080 FSF	670/2-73-064
17080 HHV	670/2-74-080
18050 DET	660/3-74-003
18050 DFQ	660/3-73-016
18050 DIJ	660/3-73-020
18050 DMB	660/3-73-017
18050 DPL	660/3-73-019
18050 ELT	660/3-74-006
18050 FLS	660/3-73-004
18080 DFU	660/3-74-014
18080 FBW	660/3-74-031
800042	650/2-75-002
800055	660/2-73-032
800055	670/2-73-032
800055	670/2-74-083
800055	670/2-74-084
800150	650/2-74-034
800250	660/2-74-091
800261	660/2-73-019
800278	660/2-74-052
800278	660/2-74-084
800316	650/2-74-110
800351	670/2-74-032

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800373	660/3-74-016
800397	650/4-74-032
800397	650/4-74-045a
800397	650/4-74-045b
800400	660/2-74-005
800401	660/2-74-033
800432	670/2-75-033a
800432	670/2-75-033b
800432	670/2-75-033c
800432	670/2-75-033d
800435	660/3-75-014
800510	660/3-73-022
800602	670/2-74-030
800605	660/3-75-004
800609	660/3-75-006
800610	660/3-75-005
800613	660/2-73-012
800613	660/2-74-085
800613	660/3-75-002
800650	670/2-74-013
800674	670/5-74-004
800677	650/3-75-003
800678	660/2-74-003
800680	660/2-73-024
800685	670/2-73-060
800688	670/2-75-031
800707	670/2-73-022
800731	660/2-75-008
800736	660/3-74-025
800745	670/2-74-070
800746	660/2-74-046
800747	660/2-74-025
800766	670/2-74-016
800767	660/2-74-063
800778	660/3-74-028
800842	650/2-74-011
800853	660/2-74-029
800854	660/2-74-071
800857	600/2-74-009a
800857	600/2-74-009b
800857	600/2-74-009c
800866	650/2-73-011
800904	660/2-74-061
800909	660/2-74-004
800921	660/2-74-048
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800935	660/2-74-074
800938	670/2-75-030
800943	660/2-74-053
800950	650/2-74-095
800989	660/3-74-027
800991	660/2-74-079
800994	660/3-74-033
800997	660/2-73-002
801000	600/5-74-022
801003	660/3-75-003
801029	660/2-73-027
801036	660/3-74-007
801039	660/3-73-018
801040	660/2-75-005
801062	660/3-74-029
801065	660/2-74-090
801120	650/4-74-004
801136	650/3-74-006
801174	650/3-74-011
801207	660/2-73-030
801226	600/5-74-027
801234	600/5-74-011
801236	670/2-75-006
801282	670/2-74-076a
801282	670/2-74-076b
801289	670/2-74-035A
801289	670/2-74-035B
801289	670/2-74-036A
801289	670/2-74-036B
801303	670/2-73-091
801321	650/2-73-020
801340	650/3-74-007
801343	660/3-74-020
801349	670/2-75-016
801361	660/3-73-023
801362	660/3-73-024
801374	600/5-73-016
801376	600/5-73-015
801393	650/1-74-010
801400	660/2-75-007
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801417	660/2-74-077
801419	600/5-75-003
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801446	650/2-74-007
801454	660/2-75-003
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801470	650/1-74-012
801473	600/5-73-012a
801473	600/5-73-012b
801473	600/5-73-012c
801473	600/5-73-012d
801473	600/5-73-012e
801481	600/5-74-029
801484	660/2-74-006
801490	650/2-73-014
801500	600/5-74-024
801521	600/5-73-007
801522	600/5-73-011
801577	660/2-74-094
801603	650/2-74-063
801615	650/2-74-027
801622	670/2-75-034
801628	600/2-74-005
801633	670/2-75-026a
801633	670/2-75-026b
801647	660/2-74-034
801650	650/1-74-011
801658	670/2-73-043
801662	660/2-74-064
801666	660/2-74-068
801684	660/2-74-075
801835	660/2-74-054
801870	670/5-74-007
801870	670/5-74-008
801870	670/5-74-009
801876	660/2-74-044
801944	670/2-75-032
801945	650/4-74-041
802005	650/1-74-002
802009-01	660/2-74-023
802032	660/2-74-011
802219	670/2-75-022
802254	670/2-73-104
802254	670/2-74-008
802269	650/2-74-080
802270	650/2-74-051
802291	650/2-74-048
802348	660/3-75-015
802366	650/2-75-012
802400	670/2-75-021
802402	650/2-74-032
802411	670/2-75-017
802419-01	650/2-74-096
802441	600/5-73-009
802444	600/5-74-021
802495	670/4-74-005
802499-01	650/2-75-023
802637	670/2-75-015
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IAG0139(D)	650/2-74-070
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IAG0177(D)	650/2-73-034
IAG0199(D)	650/2-74-057
IAG0215	650/2-74-125
IAG085(D)	650/2-75-004
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IAG4H374(D)	600/5-74-031
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